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ABSTRACT

This study examines the relationship between high computer access and "student empowerment" at the Nashville, Tennessee, site of the Apple Classroom of Tomorrow (ACOT) project. The study rests on the premise that school learning is a function of the work carried out by students in school, and that schoolwork is experienced by students as a series of specific tasks. This sequence of tasks constitutes a specific treatment which over a period of time produces thoughts, feelings, and actions which have an influence on work habits, attitudes, and achievement scores. In this study, student empowerment refers to an internal student state where the student sees himself/herself as responsible for, or in control of, the source of his/her own learning. Subjects were two fourth grade classrooms, one which participates in the ACOT project, and one which does not. Data collection included field notes, videotapes, interviews with teachers, and reviews of task materials and products. Results showed that high access to computers was associated with increased student empowerment in classroom learning settings. However, additional work needs to be undertaken to document the effects of various "profiles of student empowerment" (i.e., distribution of schoolwork task characteristics) on student learning. The text is supplemented by two figures and six tables, and two appendixes provide a copy of the task description form and a list of coding keys for several forms. (19 references) (EW)

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THE INFLUENCE OF HIGH COMPUTER ACCESS ON SCHOOLWORK AND STUDENT EMPOWERMENT: An Exploratory Study of the Nashville ACOT Site ©

by

Charles W. Fisher

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27 July 1988

This exploratory study was conducted under the auspices of the research program of the Apple Classroom of Tomorrow Project. I would like to gratefully acknowledge the contributions to the study of Faye Wilmore and Robert Howell. Their knowledge of, and willingness to discuss, issues in classroom learning was enjoyable, as well as, informative. In order to participate in the data collection, they extended an already very high level of effort. As anyone who is familiar with schools will understand, the pace of school life is demanding and the time pressures relentless. Experienced professionals, as the Nashville ACOT site staff most certainly are, make an extraordinary challenge, like the integration of educational technology in elementary schools, achievable.

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THE INFLUENCE OF HIGH COMPUTER ACCESS ON SCHOOLWORK AND STUDENT EMPOWERMENT: An Exploratory Study of the Nashville ACOT Site

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Charles W. Fisher

Introduction

Study Overview

The primary goal of this research is to characterize and document relationships between HCA and student empowerment at the Nashville site of the Apple Classroom of Tomorrow (ACOT) Project. The ACOT Project has created an innovative dynamic learning environment by introducing high computer access (HCA) to students and teachers in classrooms (and homes). In a series of public school classrooms, differing in grade level, community background, and geographic location, the ACOT Project has provided two computers per student (one for school use and one for home use) to partially simulate the presence and use of sophisticated computers in tomorrow's schools. (The simulation involves a number of other design elements, in addition to the presence of computers. See Apple Classroom of Tomorrow Project (references) for more information.) ACOT's introduction of computers in classrooms has caused, or is at least concomitant with, a number of changes in school procedures and classroom learning environments at ACOT sites. For example, ACOT classes may select their students somewhat differently or have unique curriculum components when compared to other classes in the same or nearby schools. These kinds of changes are likely to have effects on how and how much ACOT students learn. This exploratory study examines the everyday experiences of students in an ACOT class, with special attention directed to schoolwork; that is, to the tasks and activities in which students engage. This study extends work done earlier at the Cupertino ACOT site (Fisher, 1988). The rationale for the two studies is essentially the same.

The study rests on the premise that school learning is a function of the work carried out by students in school. Schoolwork is experienced by students as a series of specific tasks. This sequence of school tasks constitutes a lengthy and complex "treatment" that influences the daily thoughts, actions and feelings of students. Integrated over substantial periods of time, these thoughts, actions, and feelings are eventually expressed in work habits, attitudes, and achievement test scores. Needless to say, individual differences among students and contextual

High Computer Access

High computer access (HCA) refers to the classroom (and home) condition wherein each student has a computer available for his or her use most of the time. This condition requires several computers in the learning setting. In this study, each student has a computer in the classroom (and another computer at home). In these circumstances, a computer becomes another (personal) tool that is available for use in any task. Appropriate software and computer peripherals must also be available to operationalize high computer access.

Student Empowerment

While engaging in school tasks, students can be observed to manifest a wide variety of behaviors. The actual experience of a task, however, is usually described in terms of one or more internal states. Although internal states are not directly measurable, observable behaviors are often used (references) to infer their presence. In this study, the term student empowerment is used to refer to an internal student state. Students may be said to be empowered (literally energized or set in motion from within) or experiencing personal agency in relation to their own learning when they see themselves as responsible for, in control of, or the source of their own learning. There may be an optimization in learning capacity or efficiency for some students when they experience personal agency or empowerment, and for this reason, the phenomenon is especially relevant to education. The positive role of personal agency in learning is consistent with the cognitive view of learners as active meaning-makers (Bransford & Franks, 1976; Anderson, Spiro & Montague, 1977; Greeno, 1972; among others). Conceptualizations that appear to be closely related to empowerment include personal agency, personal causation, locus of origin (deCharms, 1976; 1983), self-efficacy (Bandura, 1977; 1982), and flow states (Csikszentmihalyi, 1975;1978), among others.

HCA and Student Empowerment

The premise in this analysis is that HCA in the instructional environment, directly and indirectly, contributes to student experiences of personal agency and empowerment. What might some of the mechanisms connecting HCA to empowerment be?

The primary mechanism is presumably the computer itself (running suitable software). Who has not experienced a sense of personal agency, a sense of personal power when, at a keystroke, a predictable result appears on the monitor. As one masters more routines in a piece of software, there is a growing sense of self-efficacy. I did that! I can change it if I want to. I have power within me (I am empowered) to control the machine. Experiences of this type illustrate a direct effect of HCA on student empowerment; an effect that is likely to influence student learning.

Direct experience of personal agency, hypothetically provided by some computer learning tasks, may be enough to transform student engagement or persistence in some non-computer tasks in the classroom. Students may be more attentive, cooperative, or motivated during "regular" recitation and seatwork tasks as a result of experiences of personal agency on some computer tasks. By making regular classroom tasks more effective, high access to computers could result in indirect effects on learning. There are likely to be other manifestations of personal agency, some of them indirect, that could be identified in classrooms with HCA. These other manifestations are hypothesized to result from the influence of HCA on the structure and distribution of school tasks.

HCA, School Tasks, and Student Empowerment

Ordinarily, teachers state the initial task description for most student tasks. In some cases, they direct students to find the task specification in written form in a textbook or other instructional material (including software). This initial description is referred to as the nominal task.

In the nominal task description, regardless of how it is presented to students, there are usually some elements of the task that are left unspecified. This lack of complete specificity gives the student an opportunity to do some "task shaping." In classes where students have some experience with personal agency (perhaps garnered as the result of HCA), there may be a tendency for students to take more responsibility for determining the "actual task." The actual task is what the student actually does after the specification gap has been filled in some manner. The hypothesis here is that, in classes with HCA, students will be more likely to take initiative themselves in reducing or eliminating this gap than would be the case in a class where students had little or no experience with personal agency in learning. (In a highly teacher-dominated class, students would be likely to "pump the teacher" to complete the task specification.) The concept of task shaping has great potential for analysis of classroom processes. As an initial step, this study attempts to document instances of students shaping the task product - adding to or changing the nominal product, embellishing or personalizing the product in various classroom contexts.

If any part of the task involves the computer, then students know that they will have some options (usually) in how they complete the task. Choosing among these options may result in additional experiences of student agency. As students accumulate experience as agents in their own learning, they may be more likely to act as agents in other areas of classroom learning.

A second phenomenon should occur in classrooms with HCA. Given that HCA fosters student experiences of personal agency and empowerment, students should make more initiations than is usually the case. On their own volition, students in classrooms with HCA might be more likely to interact with their peers, consult more sources of information, see their

peers as sources of information, and initiate more interactions with teachers and adults. That is, students with a developing sense of personal causality in their own learning are likely to develop a "bias for action." Since taking responsibility for a portion of their own learning has increased their sense of competence and control; the same students, when in doubt, stuck, or confused should be more likely to act (ask another student, look in a book, find an adult, etc.) as opposed to waiting passively for remediation. Needless to say this bias for action may be regarded as disruptive on some occasions (by both teachers and students). In some cases, students may practice an extreme form of task shaping - task substitution. That is, students may work on tasks that have no relation to the nominal task. Although task substitution has been around for a long time, HCA expands the potential for this activity by an order of magnitude.

A third manifestation of empowerment involves the amount of information flow in a classroom. Information flow is defined here as the total amount of information that is exchanged among all pairs of individuals in a given amount of time. Compared to classrooms with no computer access, classrooms with HCA are likely to have greater quantities of information flowing in them. This increase in information flow could be caused in two ways. First, with HCA there are simply more channels for information to flow through/in. Second, the effect of the bias-for-action phenomenon outlined above is likely to increase the amount of intercourse in the room. There is likely to be more activity in this new classroom environment - more mobility and greater numbers of information exchanges - therefore, greater information flow. Environments with HCA should be cognitively "hotter," resulting in greater amounts of, and faster, cognitive processing.

Summary

HCA is hypothesized to influence, directly and indirectly, student empowerment. A direct effect on student empowerment is expected because of the nature of the computer itself; an indirect effect is expected through the influence of HCA on the types and distribution of schoolwork tasks.

This exploratory study analyzes descriptive data collected during a two-week period in two fourth grade classes (one week in the regular ACOT classroom and one week in a non-ACOT classroom in the same school). The questions that structure the exploration include: What tasks constitute schoolwork for the students in each of these classrooms? What is the structure of these tasks? To what degree do students have influence on product specification associated with the tasks? Are HCA and task characteristics such as degree of product specification related? Is there evidence of student empowerment resulting from schoolwork? Are HCA and student empowerment related?

Method

Descriptive data were collected in each of two classrooms for one week. The data were systematically coded and analyzed in order to explore the primary questions of the study.

Sample

The sample consisted of two fourth grade classrooms (27 students each) in one school in Hermitage, Tennessee. One of the classes participated in the ACOT Project while the other did not. This participation and their similar grade levels were the primary factors in selection for the study. School-based selection procedures were used in identifying students admitted to the ACOT class. Membership in an ACOT class is considered to be very desirable within the school and hence, ACOT students are likely to differ in some respects from other classes of students in the school. The non-ACOT class was identified by the school site staff as an example of a class that did not use technology frequently during instruction.

Each of these classes is considered to be a case study. The ACOT class is a very special class, in that it is one of a handful of elementary school classes (anywhere in the world) with such high levels of access to computer-based educational technology. In the results section, information on each class will be presented separately, followed by an integrated discussion of the findings.

Data Collection

Data were collected in the ACOT and non-ACOT classes during the weeks of April 11th and 18th (1988) respectively. The data collection plan included four procedures.

Field notes. The investigator observed instructional activities in each classroom for one week. Instructional activities that took place in other areas of the school (for example music, library) were also observed. No field notes were taken during recess, lunch, physical education, or before or after school. Field notes consisted primarily of a running record of classroom organizational features, task specifications, and student work-related and social responses to their school work. In both classrooms, fieldnotes were taken each day for one week (in the non-ACOT classroom, no notes were taken between 2:30 PM and 3:15 PM on Wednesday and between 8:45 AM and 12:20 PM on Thursday).

Videotapes. The ACOT class was videotaped from opening to closing bells for each of the five days of the data collection period. The non-ACOT class was videotaped from Monday morning to 2:40 PM Tuesday and from 12:20 PM Thursday until Friday at 3:15 PM. Although the videotaping procedures were intended to encompass as much classroom activity as possible, on several occasions during the week, the camera was focused so that the

actions of one or more of the students or groups of students were isolated on the videotape.

For the vast majority of the time, the camera was set at "wideangle" and left running unattended. The camera was occasionally monitored by the investigator. Approximately 25 hours of videotape were shot in the ACOT classroom and 16 hours in the non-ACOT classroom. Students and staff in the ACOT classroom had had several previous experiences with videocameras in their classroom and therefore the videotaping procedure appeared to be a minor intrusion. This was not the case in the non-ACOT classroom. In this case, both students and staff seemed to be aware of the presence of the camera, especially during the first day of taping. During instruction, neither students nor staff looked at the camera frequently, however, during breaks and after school, students asked many questions about the camera and the taping procedure in general.

Interviews. During the course of the week, ACOT staff were formally interviewed four times and the non-ACOT classroom teacher twice. All interviews were conducted by the investigator. The formal interviews varied in length from 10 to 30 minutes and centered on information about classroom organization, instructional activities, student task requirements, and instructional materials (including software). In addition to these interviews, there were numerous informal interactions during breaks in the school day between the investigator and site teachers.

Task materials and products. Copies of student materials were collected including various worksheets, and writing samples. These materials provide information on the tasks students worked on and a few samples of products produced by students.

Data Analysis

Data analysis began with the primary data sources: field notes, videotapes, and interviews. Between May 30th and June 11th, the videotapes were viewed by the investigator. While viewing the tapes, field notes were read and reread in order to provide as complete a record of the students' activities as possible.

Based on previous task analysis techniques (Fisher, 1988), school work was partitioned into a sequence of tasks. Each task was primarily identified by a student objective or set of objectives. All activities that were directly related to these task objectives were included as part of the same task. In most cases, specification of task objectives, in the form of a concrete product to be produced by students, was explicit, and hence, task boundaries were relatively easy to identify. In some cases, generic tasks were repeated daily. In these cases, the task objective often was not stated explicitly, but was easily inferred by students from extensive past experience with the generic task type.

Each school work task was coded on a Task Description Form (see Appendix A). Each task was assigned an identification number and task name. Then each task was categorized in terms of: task duration; general subject matter; specific subject matter; task complexity; task size; task purpose; and task evaluation procedures. Each of the activities (or subtasks) that were associated with a task were also categorized. Activities were coded in terms of: product; student specification of process and product; format; work location in the classroom; duration; function; number of different tasks existing at the same time; number of work groups operating at the same time; and material resources used.

The tasks and activities identified in the data were keyed into a computerized data base. Rows and columns of the data base were selected and sorted in various ways to provide distributions of tasks and task characteristics within each of the classrooms. These distributions and accompanying tables are described in the results section and Appendices of this report.

School site. Dodson School is a suburban elementary school in Hermitage, Tennessee. Although part of the Metropolitan Nashville School District, the school lies approximately ten miles east of Nashville in an area of rolling hills that are rapidly becoming homesites for the growing middle class population in the area. Dodson School, with approximately 1200 students in grades K through six, is housed in three different buildings. These buildings are separated by considerable distances and, although there is a single administration, the buildings might well be separate schools, at least in terms of their day to day operation.

One of the three Dodson sites has only fourth grade students (approximately 230 students). The school building itself is a one-story design that was probably built in the fifties or sixties when open architecture was popular for schools. The school sits in a large grassy meadow with only a few houses in sight. The building retains its open feeling although most of the dozen or so classrooms are being used as self-contained spaces. Over half of the students come to school in buses; about 20 percent of the students were bussed from more urban areas of Nashville. Because of the growth of Hermitage as a bedroom community and the busing of students from well beyond the local attendance area, students at Dodson come from diverse backgrounds.

The ACOT classroom. The ACOT Project at Dodson School includes more than one classroom. This study focussed on the "regular" ACOT class and, in this report, the term ACOT class refers only to this subset of the Nashville ACOT site. The ACOT classroom included two adjacent classrooms and was separated from another classroom area by a series of tall cabinets and bookcases and from the broad central hallway of the school by two large open archways (see sketch in Figure 1). The classroom was bright with plenty of natural and florescent lighting.

Teachers' desks and files were placed at the back of the room. Each student had a desk, workspace, computer, and personal area at one of seven four-person furniture clusters arranged in v-shapes throughout the room (see Figure 1). This arrangement allowed students to have their computers on their desk tops as opposed to situations where students must travel back and forth from their regular seats to their assigned computer workstations. Distribution of electric power was handled by installing vertical "utility poles" (about 2 inches in diameter) from ceiling to floor at each furniture cluster. Electrical cables within a cluster ran to the local pole; therefore there were no cables on the floor between clusters. Each cluster had a printer.

Students worked at one of two locations in the classroom: in their seats or "upfront." Seatwork and computer work were carried out at their assigned seat. When the class engaged in discussions and recitations or when a projector was used to show "software screens" on the wall, students gathered at the front of the room. A few students sat on chairs and desks

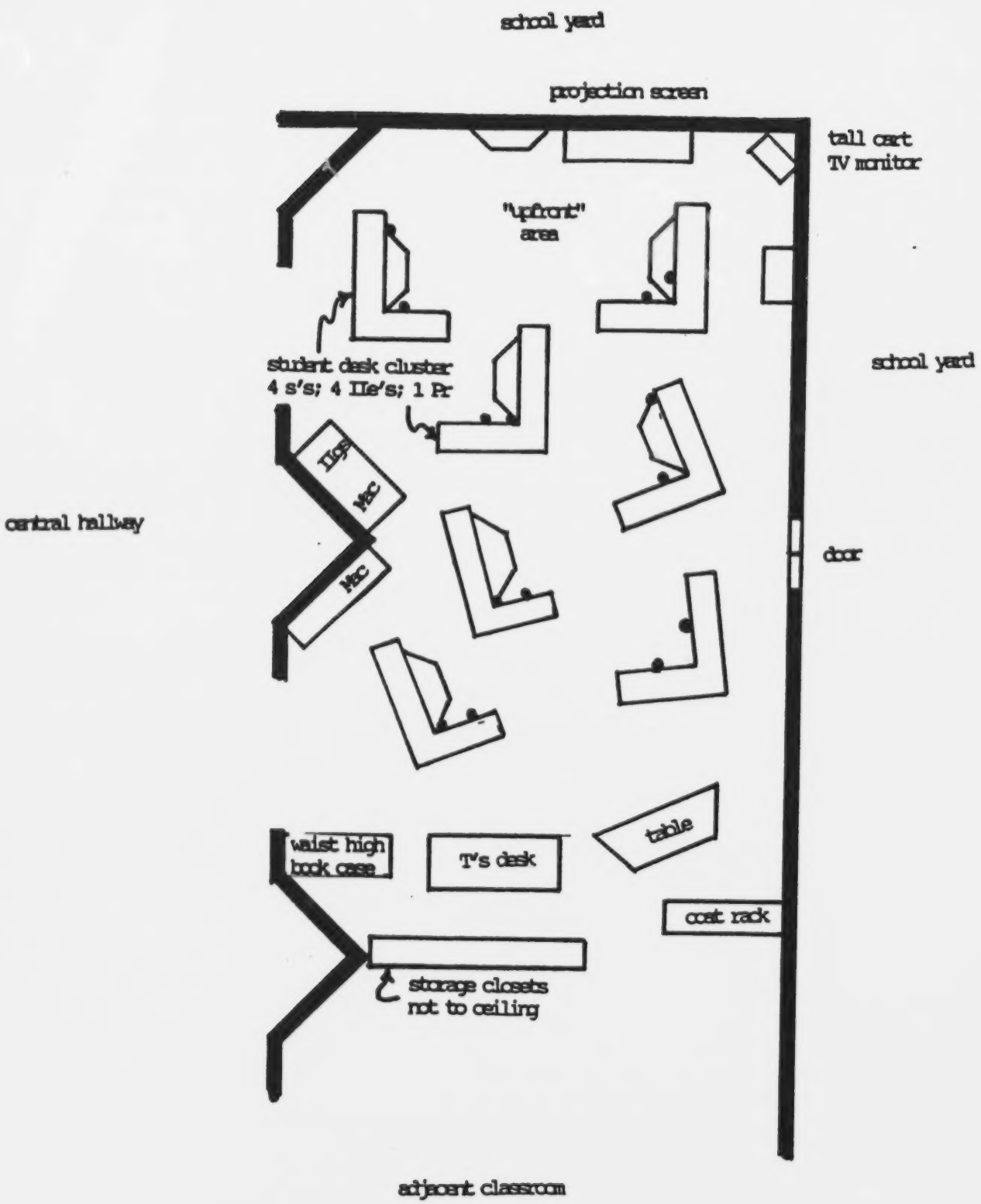

Figure 1: Sketch of the ACOT classroom

but most sat on the carpet during these upfront sessions. Students typically switched between the two locations several times each day.

Students. The ACOT class consisted of 27 students; 14 boys and 13 girls. About 90 percent of the students were white; none of the students spoke English as a second language. There was a school-based selection procedure for admission to the ACOT class; as a result, the students represented a wide range of backgrounds. The majority of the students appeared to come from middle class homes. The students were very well mannered, easy to talk with, and highly engaged in their school work. They were also very accustomed to visitors and observers in their classroom. It is very unlikely that the presence of the camera or the observer made much of an impact on their actions during the week.

Teachers. Teaching in the ACOT classroom was shared by Robert Howell (ACOT teacher) and Faye Wilmore (ACOT coordinator). Both teachers are highly-experienced, successful professionals. They both share a strong commitment to the welfare and education of their students and to the profession of teaching. They demonstrated expert organizational and management skills and ran their classes with a sense of confidence and authority.

Each day began with Ms. Wilmore taking the class for handwriting and mathematics (and Lego Logo on Monday). At 10:00 AM, Mr. Howell took over for the remainder of the day covering reading, language arts, spelling, science, and social studies. This general schedule was adapted on several occasions during the week, depending upon the instructional priorities for a given day.

Schoolwork

Outline of the school day. The school day in the ACOT class was organized as a series of subject matter content blocks. The school day began with handwriting exercises. During this time, there was a school-wide opening exercise coordinated via the public address system. The opening exercise consisted of a daily greeting, choral pledge of allegiance, and a short presentation by students (often riddles). Following the opening, the classroom teacher called for a state-mandated moment of silence after which work continued.

The main part of the morning was divided into three, more of less, equal time blocks. The first and last were devoted to mathematics and reading, respectively. The middle period of the morning varied depending on the day of the week. During the week of observation, this period was devoted to Lego Logo (Monday), science (Tuesday and Wednesday), reading (Thursday), and a spelling test (Friday). Following lunch, the afternoon was divided, more or less, into five unequal periods. The first and last periods were regularly assigned to language arts and physical education, respectively. The second period was allocated to spelling (with the exception of a music period on Friday). The third period was devoted to social studies on Monday, Wednesday and Thursday (library on Tuesday and

computer keyboard practice on Friday). The fourth period was usually devoted to journal writing. These segments varied in length somewhat from day to day. School time periods were not punctuated by bells but students understood the general time structure of the day and week. There were no recess breaks in the morning or afternoon sessions.

Time allocation during the week. The school day (for students) began at 8:45 AM and ended at 3:15 PM with 35 minutes for lunch yielding a total of 1775 minutes (29 hours and 35 minutes) per week. During the week of data collection, the 1775 minutes of the school week included 1607 minutes (91%) of school work tasks and 168 minutes (9%) of transitions, opening exercises, and cleanup activities. Of the 1607 minutes of school work tasks, 150 minutes were allocated to physical education leaving 1457 minutes of school tasks observed during the study.

School work tasks in the ACOT classroom. The 1457 minutes of school tasks that were observed during the week of April 11th represented the total time for 44 tasks. These tasks are listed in Table 1 in the sequence in which they occurred. In Table 1, the digits of task # indicate day-of-the-week and task-sequence-within-day. The table also includes subject matter, task name, task duration (T.Dur, in minutes), number of activities of which the task is composed (Acts #), task size (T.Size rated from 1 to 5), degree of complexity of the task product (Pdt.C rated from 1 to 5), and degree of complexity of social organization for the task (Soc.C rated from 1 to 5).

The tasks listed in Table 1 contain both the primary content and structure for analysis and interpretation of schoolwork. If, in the context of schoolwork, HCA is to have an effect on student empowerment, those effects must be carried by, or transferred through, one or more elements of the tasks in Table 1. Before presenting further analysis, explanation of selected variables in Table 1 and narrative descriptions of selected schoolwork tasks and their contexts are presented.

The task characteristics listed in Table 1 are either straightforward "counts" or ratings. The rated variables include task size and two aspects of task complexity (cognitive complexity of the task and complexity of the social organization necessary to complete the task).

The ratings of task size are intended to distinguish between small and large tasks. Smaller tasks are primarily differentiated from larger ones in terms of task duration, student effort required by the task, and number of intermediate products. Tasks that call for the completion of a single worksheet are clearly different in size from tasks that call for a written report on a book chapter; and these in turn, are smaller than a task that calls for the planting of bean seeds, tending the growing plants, observing, measuring and recording growth, and reporting the findings in a report. These gross differences in task size can be reliably assessed, even though fine distinctions in the size of tasks may not be practical. The intent in this analysis is to describe gross differences in task size.

Table 1: List of school work tasks in the ACOT classroom (April 11 - 15)

Task#	Sbjt.Gen	Task.name	T.Dur	Acts#	T.Size	Pdt.C	Soc.C
1.1	r&la	handwritingI	13	2	1	1	1
1.2	mathematics	fractionsI	64	4	1	1	1
1.3	misc	lego.logo	58	3	4	4	4
1.4	r&la	showtimeI	44	3	3	4	3
1.5	r&la	outliningI	48	4	1	2	1
1.6	mathematics	fractionsII	6	2	1	1	1
1.7	r&la	spellingI	8	3	1	1	1
1.8	social.stdys	governmentI	50	3	1	1	1
1.9	journal	journalI	7	1	1	2	1
2.1	r&la	handwritingII	13	1	1	1	1
2.2	mathematics	fractions.test	15	2	1	1	1
2.3	mathematics	indv.frctIII	44	2	1	1	1
2.4	science	plantsI	66	2	1	1	1
2.5	r&la	showtimeII	42	3	4	4	3
2.6	r&la	outliningII	52	2	1	2	1
2.7	r&la	spellingII	19	1	1	1	1
2.8	journal	journalII	22	1	1	2	1
2.9	r&la	library	19	1	1	2	1
3.1	r&la	handwritingIII	14	1	1	1	1
3.2	mathematics	fractionsIV	56	3	1	1	1
3.3	science	plantsII	49	2	1	1	1
3.4	r&la	showtimeIII	52	3	4	5	3
3.5	r&la	outliningIII	48	1	1	2	1
3.6	r&la	spellingIII	15	1	1	1	1
3.7	social.stdys	governmentII	43	3	1	1	1
3.8	journal	journalIII	15	1	1	2	1
4.1	r&la	handwritingIV	11	1	1	1	1
4.2	r&la	baloon.launch	17	2	2	1	3
4.3	mathematics	fractionsV	38	1	1	1	1
4.4	r&la	showtimeIV	104	3	4	5	3
4.5	r&la	outliningIV	42	3	1	2	1
4.6	r&la	spellingIV	12	2	1	1	1
4.7	social.stdys	governmentIII	19	5	1	1	1
4.8	science	plantsIII	15	2	1	1	1
4.9	misc	gen.work.time	26	3	2	2	1
5.1	r&la	handwritingV	25	2	1	1	1
5.2	mathematics	fractions.test	52	1	1	1	1
5.3	r&la	spelling.test	35	3	1	1	1
5.4	r&la	showtimeV	69	8	4	5	3
5.5	r&la	outliningV	55	2	1	2	1
5.6	music	music	33	1	2	2	3
5.7	misc	type.to.learn	13	1	2	2	1
5.8	journal	journalIV	7	1	1	2	1
5.9	mathematics	fractions.test	2	1	1	1	1

The rating of task size was done from a normative point of view. That is, task size was rated as tasks were described or set out for students. If a student was asked to read a story, and after reading it, was asked to answer a set of questions about the story, and after completing the questions, was asked to write an outline for the story; then, this sequence was considered to be three relatively small tasks. If the entire task specification had been given at the beginning (rather than piecemeal), then the task would have been considered to be relatively larger (with a number of constituent activities).

Tasks also differ in cognitive complexity; that is, some tasks may require memorization of facts while others may require integration of information and the generation of new statements or actions. Although this type of task analysis can be accomplished with considerable precision, only broad distinctions were used in this study. Low ratings on task cognitive complexity indicate memory of lower order thinking, whereas high ratings indicate higher thinking operations, problem solving, or generation of new representations for the task elements. The categories of Bloom's taxonomy, for example, represent distinctions in cognitive complexity.

Classroom tasks vary not only in the degree of cognitive complexity that individual students must deal with, but also, in the complexity of social organization within which the task takes place. That is, some tasks may be undertaken by individual students and, therefore, require only minimal (or no) interaction among students. Other tasks may be accomplished only when several students (or even classes of students) contribute to a common goal. The purpose here is to distinguish those tasks that can be completed by individuals from those that require increasingly complex social interactions for their completion.

Several tasks, taken from those observed in the ACOT classroom, are described below to provide anchors for the ratings of task size, task cognitive complexity and complexity of social organization.

Handwriting III. Each day began with a handwriting task that served as a warmup for the school day. Handwriting III (Task 3.1) is an example of a small low-complexity task. On Wednesday, this task was defined as practicing the formation of the "decender" letters (f, g, j, p, and q) as specified on page 78 of the handwriting workbook (Zaner-Bloser). Students practiced making individual letters and words (ex. foggy, garage) on scratch paper while referring to the models in the workbook; then,letters and words were written on the pages of the workbook itself. This task took 14 minutes of class time. At the end of the task, the workbooks were placed on a table at the rear of the classroom and, subsequently, examined by the teacher. This task was given a rating of 1 on task size, 1 on cognitive complexity, and 1 on complexity of social organization.

Lego Logo. Lego Logo (Task 1.3) occurred once during the week of observation (Monday morning). The goal of the task was to construct a working model using the Lego Logo materials. The materials included motors, lights, and various structural elements which can be operated by a

computer program. The task was undertaken by teams of students (6 teams varying is size from 3 to 5 members). The specific model to be built was to be decided upon by the teams. Team members took individual roles including "builders," programmers, and recorders. Models being constructed during the day of observation included a car wash, a basketball court, a jumbo jet, and a house" where the lights came on when the door was opened." This task was rated 4 on task size since there were several intermediate products required for task completion, the task required four to five hours of effort to complete (approximately one hour for each of four or five team members). Cognitive complexity of the task was rated 4 since the task required a relatively complex design, computer programming by the students to get the model to perform the functions they desired, and the repeated application of problem solving skills as the project proceeded. The complexity of social organization was rated 4 since the task required role differentiation among team members and the development of a decision making process in order for the task to be completed.

Although task size, cognitive complexity, and complexity of social organization are conceptually independent, an examination of Table 1 indicates a high positive correlation among these variables. The Lego Logo and Showtime tasks (1.3, 1.4, 2.5, 3.4, 4.4, and 5.4) account for all of the high ratings on the three variables. If we ignore music (Task 5.6) and the Balloon Launch (Task 4.2), then the tasks in the ACOT classroom form a bimodal distribution with Lego Logo and Showtime (6 tasks) in one group and the rest of the tasks in another group.

Activities. Before relating task structure to the use of educational technology and student empowerment, it is appropriate to examine schoolwork tasks more closely. Although schoolwork tasks are characterized by a unifying goal or product, some tasks have one or more intermediate products that must be completed before the task can be completed. In such cases, students may undertake separate activities (with distinct formats, materials, etc.) as they work on an intermediate product. In the simplest case, a task is made up of only one activity (for example Handwriting III described above), making the distinction between task and activity trivial. However, as tasks increase in size and complexity, there is usually an increase in the number of distinct activities that can be identified. Activities may differ in format (recitation, seatwork, computer work, etc.), function (prework activity, student work, or postwork activity), specific content, and material resources necessary for the activity.

The tasks in Table 1 vary considerably (from a minimum of 1 to a maximum of 8) in terms of the number of constituent activities. Table 2 lists the 97 activities that make up the 44 tasks identified for the week. The first two columns of Table 2 are the task number and task name (same as Table 1); column 3 is the activity number; columns 4 and 5 are degree of activity process specification and degree of activity product specification, respectively; column 6 is activity duration (in minutes); column 7 is activity function; columns 8 and 9 are primary and secondary activity formats, respectively; column 10 is activity location; column 11

Table 2: List of activities in the ACOT classroom
(in temporal sequence)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	W.Gp	Res.1	Res.2	Teach
1.1	handwritingI	1	0	0	2	pr	vd(t)	-	s	1	1	wb	-	fw
1.1	handwritingI	2	1	1	11	w	sw(ws)	-	s	1	1	wb	-	fw
1.2	fractionsI	1	0	0	6	pr	dem	ex	f	1	1	cb	-	fw
1.2	fractionsI	2	0	0	10	pr	dem	ex	f	1	1	sw	bs	fw
1.2	fractionsI	3	1	1	14	w	ex	q&a	f	1	1	t	cb	fw
1.2	fractionsI	4	2	1	34	w	cw(dp)	sw(tp)	s	1	1	sw	t	fw
1.3	lego.logo	1	0	0	2	pr	vt(tm)	-	s	1	1	-	-	fw
1.3	lego.logo	2	5	5	44	w	sqllc	-	llt	1	6	ll	c	fw
1.3	lego.logo	3	0	0	12	po	ex	q&a	f	1	1	-	-	fw
1.4	showtimeI	1	2	3	21	prw	dem(c)	-	f	1	1	sw	bs	rh
1.4	showtimeI	2	0	0	5	pr	vd(tm)	vd(t)	f	1	1	-	-	rh
1.4	showtimeI	3	3	3	18	w	vd(t)	cw(s)	s(t)	1	8	sw	ho	rh
1.5	outliningI	1	0	0	5	pr	vd(t)	-	s	1	1	-	-	rh
1.5	outliningI	2	0	0	1	pr	ex	-	s	1	1	-	-	rh
1.5	outliningI	3	0	0	4	pr	vd(tm)	-	s	1	1	ho	-	rh
1.5	outliningI	4	3	3	38	w	cw(wp)	sw(wo)	s	1	1	ho	sw	rh
1.6	fractionsII	1	1	1	4	w	ex	-	f	1	1	cb	-	fw
1.6	fractionsII	2	0	0	2	pr	vd(t)	-	f	1	1	-	-	fw
1.7	spellingI	1	2	2	3	prw	vd(t)	-	s	1	1	t	-	rh
1.7	spellingI	2	3	3	3	w	dis	ex	s	1	1	di	-	rh
1.7	spellingI	3	0	0	2	pr	vd(t)	-	s	1	1	t	-	rh
1.8	governmentI	1	2	2	8	pow	rec	-	f	1	1	t	-	rh
1.8	governmentI	2	3	3	13	w	dis	ex	f	1	1	-	-	rh
1.8	governmentI	3	2	2	29	pow	rec	ex	f	1	1	t	-	rh
1.9	journalI	1	3	3	7	w	cw(wp)	-	s	1	1	sw	-	rh
2.1	handwritingII	1	1	1	13	w	sw(ws)	vd(t)	s	1	1	wb	-	fw
2.2	fractions.test	1	1	1	12	w	sw(tp)	-	s	1	1	ho	-	fw
2.2	fractions.test	2	0	0	3	po	vf	-	s	1	1	-	-	fw
2.3	ind.fractionsI	1	1	1	18	w	sw(tp)	-	s	1	1	t	p&p	fw
2.3	indiv.fraction	2	2	1	26	w	cw(dp)	-	s	1	1	sw	-	fw
2.4	plantsI	1	3	3	34	pow	rec	dis	f	1	1	t	-	rh
2.4	plantsI	2	3	2	32	w	sw(r)	cw(wp)	s	1	1	t	sw(wp)	rh
2.5	showtimeII	1	0	0	11	pr	vd(t)	-	f	1	1	ho	cb	rh
2.5	showtimeII	2	5	5	29	w	sw(sw)	cw(s)	s(t)	1	8	ho	sw	rh
2.5	showtimeII	3	0	0	2	pr	vd(t)	-	f	1	1	-	-	rh
2.6	outliningII	1	3	3	51	w	cw(wp)	sw(wo)	s	1	1	ho	sw	rh
2.6	outliningII	2	0	0	1	po	vf	vd(tm)	s	1	1	-	-	rh
2.7	spellingII	1	2	2	19	pow	rec	dis	s	1	1	t	p&p	rh
2.8	journalII	1	3	3	22	w	cw(wp)	-	s	1	1	sw	-	rh
2.9	library	1	3	2	19	w	lb	trs	l	2	2	books	-	lib
3.1	handwritingIII	1	1	1	14	w	sw(ws)	-	s	1	1	wb	p&p	fw
3.2	fractionsIV	1	0	0	5	pr	vd(tm)	-	s	1	1	sw	-	fw
3.2	fractionsIV	2	2	2	23	w	cw(dp)	-	s	2	2	sw	p&p	fw
3.2	fractionsIV	3	1	1	28	w	ex	dem	f	2	2	cb	ho	fw
3.3	plantsII	1	3	3	34	pow	dis	q&a	f	1	1	t	-	rh
3.3	plantsII	2	2	2	15	pow	rec	-	f	1	1	t	p&p	rh
3.4	showtimeIII	1	0	0	2	po	vf	-	f	1	1	-	-	rh
3.4	showtimeIII	2	5	5	46	w	cw(s)	-	s(t)	1	8	sw	ho	rh
3.4	showtimeIII	3	0	0	4	po	vf	vd(t)	f	1	1	-	-	rh

Table 2 (cont'd): List of activities in the ACOT classroom
(in temporal sequence)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	W.Gp	Res.1	Res.2	Teach
3.5	outliningIII	1	3	3	48	w	cw(wp)	-	s	2	2	sw	ho	rh
3.6	spellingIII	1	2	2	15	pow	rec	q&a	s	1	1	t	p&p	rh
3.7	governmentII	1	3	3	31	w	ex	q&a	f	1	1	t	p&p	rh
3.7	governmentII	2	2	2	9	pow	rec	dis	f	1	1	t	p&p	rh
3.7	governmentII	3	0	0	3	po	g	-	f	1	1	p&p	-	rh
3.8	journalIII	1	3	3	15	w	cw(wp)	-	s	1	1	sw	-	rh
4.1	handwritingIV	1	1	1	11	w	sw(ws)	-	s	1	1	wb	p&p	fw
4.2	baloon.launch	1	3	2	7	w	special	-	s	1	1	baloon-		rh/fw
4.2	baloon.launch	2	3	2	10	w	special	-	hdtop	1	1	baloon-		rh/fw
4.3	fractionsV	1	2	2	38	w	cw(dp)	-	s	1	1	sw	-	fw
4.4	showtimeIV	1	0	0	4	pr	vd(t)	-	f	1	1	-	-	rh
4.4	showtimeIV	2	5	5	91	w	cw(s)	-	s(t)	1	8	sw	p&p	rh
4.4	showtimeIV	3	0	0	9	po	vd(t)	vf	f	1	1	-	-	rh
4.5	outliningIV	1	0	0	4	pr	vd(t)	-	s	1	2	t	sw	rh
4.5	outliningIV	2	3	3	36	w	cw(wp)	-	s	1	2	t	sw	rh
4.5	outliningIV	3	1	1	2	w	ex	dem	s	1	2	t	sw	rh
4.6	spellingIV	1	1	1	9	pow	rec	-	s	1	1	t	p&p	rh
4.6	spellingIV	2	0	0	3	po	g	-	s	1	1	p&p	-	rh
4.7	governmentIII	1	1	1	5	pow	rec	-	f	1	1	t	p&p	rh
4.7	governmentIII	2	3	3	4	w	q&a	-	f	1	1	t	-	rh
4.7	governmentIII	3	0	0	4	po	g	-	f	1	1	t	p&p	rh
4.7	governmentIII	4	0	0	1	pr	td(t)	-	f	1	1	t	-	rh
4.7	governmentIII	5	3	3	5	w	ex	q&a	f	1	1	tbb	-	rh
4.8	plantsIII	1	3	3	13	pow	q&a	dis	f	1	1	t	-	rh
4.8	plantsIII	2	2	2	2	pow	rec	-	f	1	1	t	-	rh
4.9	gen.work.time	1	0	0	1	pr	vd(tm)	-	f	1	1	-	-	rh
4.9	gen.work.time	2	3	2	4	w	q&a	-	f	1	1	pc	-	rh
4.9	gen.work.time	3	3	3	21	w	cw(wp)	-	s	4	4	sw	t	rh
5.1	handwritingV	1	0	0	3	pr	vd(t)	-	s	1	1	wb	-	fw
5.1	handwritingV	2	3	3	22	w	sw(wl)	-	s	2	2	wb	-	fw
5.2	fractions.test	1	1	1	52	w	sw(tp)	-	s	2	2	ts	p&p	fw
5.3	spelling.test	1	2	2	21	w	st(r)	-	s	1	1	p&p	-	rh
5.3	spelling.test	2	2	2	12	w	sw(ws)	-	s	1	1	p&p	t	rh
5.3	spelling.test	3	0	0	2	po	g	-	s	1	1	p&p	-	rh
5.4	showtimeV	1	0	0	2	pr	vd(tm)	-	s	1	1	-	-	rh
5.4	showtimeV	2	0	0	5	pr	vd(t)	-	f	2	2	p&p	-	rh
5.4	showtimeV	3	3	3	12	pow	vsp	-	f	2	2	sw	bs	rh
5.4	showtimeV	4	0	0	2	po	g	-	f	2	2	p&p	-	rh
5.4	showtimeV	5	0	0	2	po	dis	vf	f	2	2	-	-	rh
5.4	showtimeV	6	0	0	2	pr	vd(t)	-	f	2	2	-	-	rh
5.4	showtimeV	7	5	5	42	w	cw(s)	-	s(t)	2	9	sw	p&p	rh
5.4	showtimeV	8	0	0	2	po	q&a	-	f	1	1	-	-	rh
5.5	outliningV	1	0	0	2	pr	vd(tm)	-	s	1	1	sw	t	rh
5.5	outliningV	2	3	3	53	w	cw(wp)	-	s	2	2	sw	t	rh
5.6	music	1	2	2	33	w	music	-	hall	1	1	sm	pipes	rh
5.7	type.to.learn	1	2	2	13	w	cw(dpt)		s	1	1	sw	-	rh
5.8	journalIV	1	3	3	7	w	cw(wp)	-	s	1	1	sw	-	rh
5.9	fractions.test	1	0	0	2	po	vf	vd(tm)	s	1	1	-	-	fw

is number of different tasks being worked on (in the classroom) at the same time; column 12 is number of student work groups; columns 13 and 14 list resources in use; and column 15 indicates the instructor. (Keys for the codes and additional information on selected variables in Table 2 are provided in Appendix B).

Activity function. From work at the Cupertino site (Fisher, 1988), three activity functions were identified. Typically the first activity of a task describes a goal (and in many cases, the process to be followed). Often the teacher will call the students to a special place in the room and "set" the task that will occupy the next time block. Not only is the task itself "set" but usually there will be information about task management (grouping, where to get materials, where to work, what to do with the completed product, etc.). Activities that fill this general function (setting the task) are labeled prework activities (pr) for purposes of the present analysis.

Setting of the task is usually followed by one or more activities during which students actually carry out the task. These activities are labeled work activities (w). Sometimes there is an activity that follows the work activity during which the work is discussed, reflected upon, shared with others, or evaluated in some way. Activities of this latter type are labeled post activities (po).

Generally, a task is made up of activities that follow the sequence: prework; work; postwork. However, any of the functions may be "missing" in the sequence and any given task may have more than one activity with the same function. For example, in this typology, homework is described as a prework activity (setting the homework assignment) followed, a day or so later, by a postwork activity (discussing or correcting the homework). Since the homework itself was done outside of school, the sequence of in-school activities appears to be missing a work activity. A very common schoolwork pattern consists of prework activity, work activity, another prework activity (new task), work activity, prework activity (new task), work activity and so on. This sequence represents those cases where a task is set, students do the work (and hand in a product), the next task is set, students do the work (hand in a second product), etc. In this scenario, no time is devoted to discussing or evaluating the work after it has been completed. Such instruction is driven by task completion with little or no time devoted to articulation of the meaning of the work segments. This constitutes another example of a "missing" function.

This typology is useful for analyzing sequences of school work and the instruction that is interwoven with the work. The distribution of times spent in the three functions may have consequences for learning and for attitudes toward learning. For example, if the proportion of time spent in work activities is consistently less than 50% of the total time, then one might question the appropriateness of the task design.

Table 3 presents the activities (from Table 2) sorted by activity function. Twenty-two of the activities (23%) are prework activities. There are 46 work activities (47%) and 14 post activities (14%). Thirteen

Table 3: List of activities in the ACOT classroom
(sorted by A.Fctn, Pdt.S, and A.Dur)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	W.Gp	Res.1	Res.2	Teach
2.5	showtimeII	1	0	0	11	pr	vd(t)	-	f	1	1	ho	cb	rh
1.2	fractionsI	2	0	0	10	pr	dem	ex	f	1	1	sw	bs	fw
1.2	fractionsI	1	0	0	6	pr	dem	ex	f	1	1	cb	-	fw
1.5	outliningI	1	0	0	5	pr	vd(t)	-	s	1	1	-	-	rh
1.4	showtimeI	2	0	0	5	pr	vd(tm)	vd(t)	f	1	1	-	-	rh
3.2	fractionsIV	1	0	0	5	pr	vd(tm)	-	s	1	1	sw	-	fw
5.4	showtimeV	2	0	0	5	pr	vd(t)	-	f	2	2	p&p	-	rh
4.4	showtimeIV	1	0	0	4	pr	vd(t)	-	f	1	1	-	-	rh
4.5	outliningIV	1	0	0	4	pr	vd(t)	-	s	1	2	t	sw	rh
1.5	outliningI	3	0	0	4	pr	vd(tm)	-	s	1	1	ho	-	rh
5.1	handwritingV	1	0	0	3	pr	vd(t)	-	s	1	1	wb	-	fw
1.3	lego.logo	1	0	0	2	pr	vt(tm)	-	s	1	1	-	-	fw
1.7	spellingI	3	0	0	2	pr	vd(t)	-	s	1	1	t	-	rh
5.4	showtimeV	6	0	0	2	pr	vd(t)	-	f	2	2	-	-	rh
1.1	handwritingI	1	0	0	2	pr	vd(t)	-	s	1	1	wb	-	fw
2.5	showtimeII	3	0	0	2	pr	vd(t)	-	f	1	1	-	-	rh
1.6	fractionsII	2	0	0	2	pr	vd(t)	-	f	1	1	-	-	fw
5.5	outliningV	1	0	0	2	pr	vd(tm)	-	s	1	1	sw	t	rh
5.4	showtimeV	1	0	0	2	pr	vd(tm)	-	s	1	1	-	-	rh
4.7	governmentIII	4	0	0	1	pr	td(t)	-	f	1	1	t	-	rh
4.9	gen.work.time	1	0	0	1	pr	vd(tm)	-	f	1	1	-	-	rh
1.5	outliningI	2	0	0	1	pr	ex	-	s	1	1	-	-	rh
1.4	showtimeI	1	2	3	21	prw	dem(c)	-	f	1	1	sw	bs	rh
1.7	spellingI	1	2	2	3	prw	vd(t)	-	s	1	1	t	-	rh
4.4	showtimeIV	2	5	5	91	w	cv(s)	-	s(t)	1	8	sw	p&p	rh
3.4	showtimeIII	2	5	5	46	w	cv(s)	-	s(t)	1	8	sw	ho	rh
1.3	lego.logo	2	5	5	44	w	sgllc	-	llt	1	6	ll	c	fw
5.4	showtimeV	7	5	5	42	w	cv(s)	-	s(t)	2	9	sw	p&p	rh
2.5	showtimeII	2	5	5	29	w	sv(sw)	cv(s)	s(t)	1	8	ho	sw	rh
5.5	outliningV	2	3	3	53	w	cv(wp)	-	s	2	2	sw	t	rh
2.6	outliningII	1	3	3	51	w	cv(wp)	sv(wo)	s	1	1	ho	sw	rh
3.5	outliningIII	1	3	3	48	w	cv(wp)	-	s	2	2	sw	ho	rh
1.5	outliningI	4	3	3	38	w	cv(wp)	sv(wo)	s	1	1	ho	sw	rh
4.5	outliningIV	2	3	3	36	w	cv(wp)	-	s	1	2	t	sw	rh
3.7	governmentII	1	3	3	31	w	ex	q&a	f	1	1	t	p&p	rh
2.8	journalII	1	3	3	22	w	cv(wp)	-	s	1	1	sw	-	rh
5.1	handwritingV	2	3	3	22	w	sv(wl)	-	s	2	2	wb	-	fw
4.9	gen.work.time	3	3	3	21	w	cv(wp)	-	s	4	4	sw	t	rh
1.4	showtimeI	3	3	3	18	w	vd(t)	cv(s)	s(t)	1	8	sw	ho	rh
3.8	journalIII	1	3	3	15	w	cv(wp)	-	s	1	1	sw	-	rh
1.8	governmentI	2	3	3	13	w	dis	ex	f	1	1	-	-	rh
1.9	journalI	1	3	3	7	w	cv(wp)	-	s	1	1	sw	-	rh
5.8	journalIV	1	3	3	7	w	cv(wp)	-	s	1	1	sw	-	rh
4.7	governmentIII	5	3	3	5	w	ex	q&a	f	1	1	tbb	-	rh
4.7	governmentIII	2	3	3	4	w	q&a	-	f	1	1	t	-	rh
1.7	spellingI	2	3	3	3	w	dis	ex	s	1	1	di	-	rh
4.3	fractionsV	1	2	2	38	w	cv(dp)	-	s	1	1	sw	-	fw
5.6	music	1	2	2	33	w	music	-	hall	1	1	sm	pipes	rh
2.4	plantsI	2	3	2	32	w	sv(r)	cv(wp)	s	1	1	t	sw(wp)	rh

Table 3 (cont'd): List of activities in the ACOT classroom
(sorted by A.Fctn, Pdt.S, and A.Dur)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	W.Gp	Res.1	Res.2	Teach
3.2	fractionsIV	2	2	2	23	w	cw(dp)	-	s	2	2	sw	p&p	fw
5.3	spelling.test	1	2	2	21	w	st(r)	-	s	1	1	p&p	-	rh
2.9	library	1	3	2	19	w	lb	trs	l	2	2	books	-	lib
5.7	type.to.learn	1	2	2	13	w	cw(dpt)		s	1	1	sw	-	rh
5.3	spelling.test	2	2	2	12	w	sw(ws)	-	s	1	1	p&p	t	rh
4.2	baloon.launch	2	3	2	10	w	special	-	hdtop	1	1	baloon-		rh/fw
4.2	baloon.launch	1	3	2	7	w	special	-	s	1	1	baloon-		rh/fw
4.9	gen.work.time	2	3	2	4	w	q&a	-	f	1	1	pc	-	rh
5.2	fractions.test	1	1	1	52	w	sw(tp)	-	s	2	2	ts	p&p	fw
1.2	fractionsI	4	2	1	34	w	cw(dp)	sw(tp)	s	1	1	sw	t	fw
3.2	fractionsIV	3	1	1	28	w	ex	dem	f	2	2	cb	ho	fw
2.3	indiv.fraction	2	2	1	26	w	cw(dp)	-	s	1	1	sw	-	fw
2.3	ind.fractionsI	1	1	1	18	w	sw(tp)	-	s	1	1	t	p&p	fw
1.2	fractionsI	3	1	1	14	w	ex	q&a	f	1	1	t	cb	fw
3.1	handwritingIII	1	1	1	14	w	sw(ws)	-	s	1	1	wb	p&p	fw
2.1	handwritingII	1	1	1	13	w	sw(ws)	vd(t)	s	1	1	wb	-	fw
2.2	fractions.test	1	1	1	12	w	sw(tp)	-	s	1	1	ho	-	fw
4.1	handwritingIV	1	1	1	11	w	sw(ws)	-	s	1	1	wb	p&p	fw
1.1	handwritingI	2	1	1	11	w	sw(ws)	-	s	1	1	wb	-	fw
1.6	fractionsII	1	1	1	4	w	ex	-	f	1	1	cb	-	fw
4.5	outliningIV	3	1	1	2	w	ex	dem	s	1	2	t	sw	rh
3.3	plantsII	1	3	3	34	pow	dis	q&a	f	1	1	t	-	rh
2.4	plantsI	1	3	3	34	pow	rec	dis	f	1	1	t	-	rh
4.8	plantsIII	1	3	3	13	pow	q&a	dis	f	1	1	t	-	rh
5.4	showtimeV	3	3	3	12	pow	vsp	-	f	2	2	sw	bs	rh
1.8	governmentI	3	2	2	29	pow	rec	ex	f	1	1	t	-	rh
2.7	spellingII	1	2	2	19	pow	rec	dis	s	1	1	t	p&p	rh
3.6	spellingIII	1	2	2	15	pow	rec	q&a	s	1	1	t	p&p	rh
3.3	plantsII	2	2	2	15	pow	rec	-	f	1	1	t	p&p	rh
3.7	governmentII	2	2	2	9	pow	rec	dis	f	1	1	t	p&p	rh
1.8	governmentI	1	2	2	8	pow	rec	-	f	1	1	t	-	rh
4.8	plantsIII	2	2	2	2	pow	rec	-	f	1	1	t	-	rh
4.6	spellingIV	1	1	1	9	pow	rec	-	s	1	1	t	p&p	rh
4.7	governmentIII	1	1	1	5	pow	rec	-	f	1	1	t	p&p	rh
1.3	lego.logo	3	0	0	12	po	ex	q&a	f	1	1	-	-	fw
4.4	showtimeIV	3	0	0	9	po	vd(t)	vf	f	1	1	-	-	rh
3.4	showtimeIII	3	0	0	4	po	vf	vd(t)	f	1	1	-	-	rh
4.7	governmentIII	3	0	0	4	po	g	-	f	1	1	t	p&p	rh
4.6	spellingIV	2	0	0	3	po	g	-	s	1	1	p&p	-	rh
3.7	governmentII	3	0	0	3	po	g	-	f	1	1	p&p	-	rh
2.2	fractions.test	2	0	0	3	po	vf	-	s	1	1	-	-	fw
5.4	showtimeV	8	0	0	2	po	q&a	-	f	1	1	-	-	rh
5.4	showtimeV	5	0	0	2	po	dis	vf	f	2	2	-	-	rh
5.3	spelling.test	3	0	0	2	po	g	-	s	1	1	p&p	-	rh
5.9	fractions.test	1	0	0	2	po	vf	vd(tm)	s	1	1	-	-	fw
5.4	showtimeV	4	0	0	2	po	g	-	f	2	2	p&p	-	rh
3.4	showtimeIII	1	0	0	2	po	vf	-	f	1	1	-	-	rh
2.6	outliningII	2	0	0	1	po	vf	vd(tm)	s	1	1	-	-	rh

of the remaining 15 activities alternated quickly between work and postwork and are labeled as a combination "pow" in Table 3. Two activities combined prework and work activities (labeled "prw").

Degree of product specification. Schoolwork tasks vary in the degree to which the products of the work are specified. In most cases, students work on tasks that have been highly specified as part of the task "setting" described in the prework activity. In some cases, the tasks that students work on are partially specified, leaving a certain amount of discretion to the student in completing the work. Some examples may clarify the concept.

Handwriting III (described earlier) is a one activity task. The work students undertook was completely specified by the teacher and the handwriting workbook. In the main, any deviation from the initial task specification would be evaluated negatively. From the student's point of view, this task was fully specified when the student was assigned the task. There was no, or at least very little, discretion on the student's part regarding the letters to practice, where to write the letters, or what form the letters were to take.

The product of the Lego Logo task (described above) was only partially specified when students were assigned the task. That is, students were assigned the task of building a working model using the Lego Logo materials, but the specific model to be built, how to build it, and what the form and function of the model would be, were not specified as part of the initial product description. In this case, students had some discretion in completing the product specification. In fact, the final specification emerged only after the student teams began work on the task.

The degree of product specification (by students) was rated from 1 to 5 depending on the amount of student discretion (or decision making) in arriving at the product. Since the degree of product specification can vary from activity to activity within a task, ratings were made at the level of activities. In addition, since the degree of task specification relates mainly to work activities, as opposed to prework or postwork activities, ratings were made for work activities only. Handwriting III was rated 1 and the Lego Logo work activity was rated 5.

Table 2 indicates the ratings for the activities observed during data collection. In Table 3, the same activities are sorted by function, within function by degree of product specification, and within product specification by activity duration. Note that Lego Logo and Showtime activities account for all of the high ratings. The majority of activities were given intermediate ratings (2's and 3's) on degree of product specification.

An analogous rating procedure was developed for degree of activity process specification. However, an examination of Table 2 or Table 3 reveals that the degree of process and product specification were nearly identical. Given the relatively crude rating scale categories, the two

variables are empirically indistinguishable and therefore, the degree of process specification is dropped from further consideration for the purposes of this study.

Activity product specification and computer use. Tables 2 and 3 include information on the instructional format that characterized each of the activities. A key to the format codes is included as part of Appendix B. The format of an activity describes the work arrangements of primary (format 1) and secondary (format 2) importance during the activity. Recitation (rec) and seatwork (sw), for example, are very common elementary school formats. In this section of the analysis, the focus was on activities that used computer work (cw) format.

Note that the bottom portion of Table 3 lists the 46 work activities for the week. These work activities are listed in descending order by degree of product specification. Examine the format columns that are associated with each degree of product specification. The formats of the five work activities with Pdt.S = 5 all involve use of computers. Four of these activities use the Showtime theatre simulation; the fifth uses the computer for control of Lego Logo devices. Computer related formats accounted for 252 minutes or 100% of the time when students had the greatest discretion in specifying the product (Pdt.S = 5).

The next group of work activities were rated 3 on degree of product specification. Of the 17 activities with Pdt.S = 3, 12 had formats using computers. Eleven of these computer work formats, used the computer for word processing, and one format used the Showtime theatre simulation. The 5 non-computer formats (when Pdt.S = 3) were explanation, discussion, and/or question and answer formats used in social studies (government) and spelling. These non-computer formats, compared to computer related formats, were relatively short in duration. The non-computer formats accounted for 56 minutes of instruction while the computer formats accounted for 338 minutes (88%) of instruction (for Pdt.S = 3).

Of the 11 work activities with Pdt.S = 2, four had computer related formats accounting for 106 minutes (50%). Three of these work activities used the computer to present drill and practice in fractions; one work activity used the computer for word processing as a secondary format.

Thirteen work activities were characterized by low student product specification (Pdt.S = 1). Two of these activities (60 minutes 25%) involved computer related formats; drill and practice in fractions in both cases. The 11 non-computer related formats were predominantly paper and pencil seatwork.

This examination of activity product specification and computer use reveals two trends. First, as the degree of student product specification increases, use of computer related formats also increases in terms of both proportion of activities and proportion of instructional time. Second, as the degree of student product specification increases, the use of computers shifts from drill and practice to word processing to simulations and programming.

The classroom. Between April 18th and 22nd, data were collected in Ms. Brown's fourth grade classroom (a classroom with low access to computers) at Dodson Elementary School. This classroom was less than 100 feet away from the ACOT classroom. Though Ms. Brown's classroom was smaller in size (a not unimportant consideration), the physical description of the room itself was very similar to the ACOT classroom. As noted earlier, Dodson school was built to compliment the implementation of open education. Therefore, the classrooms had large doorways opening to the oversized central hallway of the building (folding doors were provided for these doorways but were rarely used) and essentially no walls between adjacent classrooms.

Ms. Brown's room was the middle room in a group of three classrooms. One wall of the classroom was an outside wall of the school (with two doors), one wall (with the large doorway) separated the classroom from the hallway, and the other two "walls" were open to classrooms on either side of Ms. Brown's room (see Figure 2). Access to the classrooms on either side had been blocked by bookcases, tables, and an aquarium, but sight lines remained unobstructed. This classroom was equivalent to one-half of the two-classroom area that housed the ACOT class at the other end of the building.

The teacher's desk was placed to one side of the doorway to the hall. There were large chalkboards on either side of this doorway and on the rear wall of the classroom. Students kept their belongings in a large cabinet with individual sliding trays near the back of the room. Students were seated around 6 tables (4 or 5 to a table) and the tables themselves were placed in a large circle taking up almost all of the classroom. Students worked all day at their desks; no other classroom space was used regularly as a change of location.

Students. The class consisted of 27 students; 15 girls and 12 boys. About 70 percent of the students were white; none of the students spoke English as a second language. The students were well mannered, easy to talk with, and attentive to their schoolwork. There appeared to be considerable variation in their backgrounds; some students lived in the vicinity of the school while others were bussed from nearby suburbs or from urban areas of Nashville. Having an observer and a camera in the classroom was a novelty for the students and during non-class time, students asked many questions about the research and equipment.

Teacher. Ms. Brown did all of the teaching with the exception of one-half hour of physical education each day, and music and library once a week. Ms. Brown was in her first year of teaching, having student taught at Dodson the previous year (and having attended Dodson as a student some years earlier). The students showed many signs of positive regard for her and clearly appreciated her energetic efforts to teach them. Most of the teaching was textbook-based direct instruction. Ms. Brown was highly conscientious and her desire to do a good job was always in evidence.

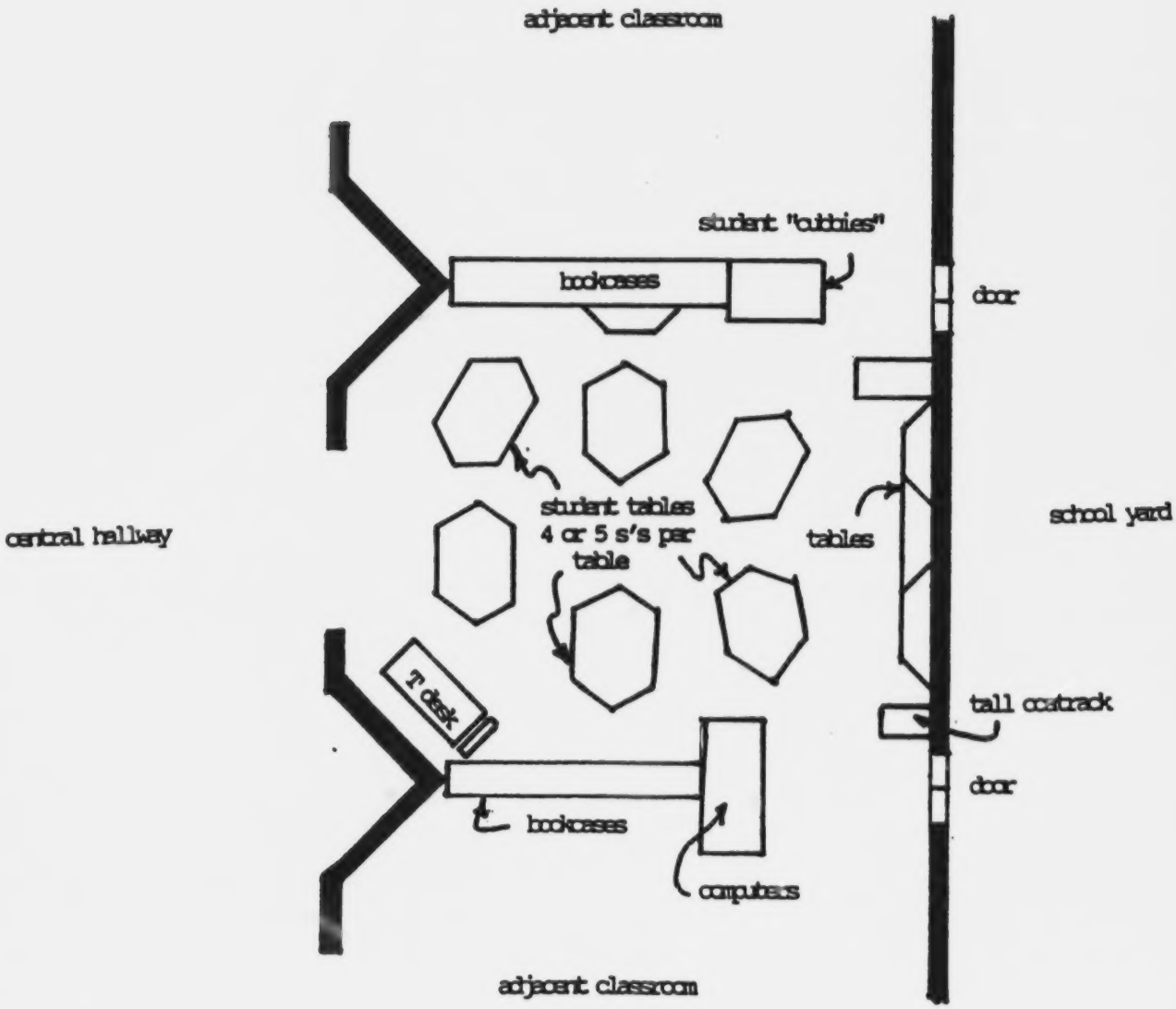

Figure 2: Sketch of the non-ACOT classroom

Although there were several computers and a printer stationed at the rear of Ms. Brown's classroom in an area shared with the adjacent class, students were not observed to use the machines during the five days of data collection.

Schoolwork

Outline of the school day. Each school day was organized as a series of subject matter time blocks. The length of a block varied widely across the day and across days of the week. The order of subjects varied from day to day. The class schedule was not constrained by lunch or other "fixed" times; if a lesson was not completed by, say lunchtime, then, it was continued after lunch. The mornings usually included two time blocks consisting of spelling, mathematics, social studies, or reading. Afternoon sessions included physical education for one-half hour each day (2:00 - 2:30 PM); library on Tuesday (1:30 - 2:00 PM); music on Thursday (three classes combined 12:30 - 1:30 PM); and a problem solving class on Friday (students from several classes are combined for the EXCEL program 12:30 - 1:00 PM). The remaining time during the afternoon sessions were allocated to two or three subject matter lessons (reading, social studies, spelling, mathematics, or science). There were no recesses in the morning or afternoon.

Time allocation during the week. The school week for students at Dodson Elementary School is 1775 minutes (5 hours and 55 minutes per day). No observations were made in Ms. Brown's classroom between physical education on Wednesday and lunch on Thursday (3 hours and 40 minutes). The total time accounted for by the observation study was 1555 minutes. This total of 1555 minutes included 1411 minutes (91%) of school worktasks and 144 minutes (9%) of transitions, opening exercises, and cleanup activities. Of the 1411 minutes of school tasks, 150 minutes were allocated to physical education leaving 1261 minutes of school tasks observed during the study.

School work tasks in the non-ACOT classroom. The 1261 minutes of school work tasks that were observed during the week of April 18th represented the total time for 31 tasks. These tasks are listed in Table 4 in the sequence in which they occurred. (Table 4 is analogous to Table 1; for general information about the Table see pages 13-16.) Task duration in the non-ACOT classroom averaged 41 minutes with several tasks reaching approximately two hours in length. Selected tasks are briefly described below.

Lines and angles I. On Monday, information on lines and angles (Task 1.2) was introduced to the students for the first time. The session began with the teacher calling on a student to read the objectives for the unit from the chalkboard followed by teacher comments on the objectives (5 minutes). The teacher then introduced definitions for lines, points, angles, rays, etc. while drawing appropriate diagrams on the chalkboard. Students were asked repeatedly to name the line, line segment, point, or angle being pointed to on the chalkboard by the teacher (55 minutes).

Table 4: List of school work tasks in the non-ACOT classroom (April 18 - 22)

Task#	Sbjt.Gen	Task.name	T.Dur	Acts#	T.Size	Pdt.C	Soc.C
1.1	r&la	spellingI	24	2	1	1	1
1.2	mathematics	lines.anglesI	163	7	1	1	1
1.3	misc	class.election	17	1	1	1	2
1.4	r&la	r.la.reward	4	1	1	1	1
1.5	r&la	facts.p.bioI	56	6	1	1	1
1.6	social.stdys	geographyI	26	2	1	1	1
1.7	misc	rev.hmw.assgnmts	2	1	1	1	1
1.8	misc	copy.seatwork	11	1	1	1	1
2.1	mathematics	lines.anglesII	122	9	1	1	1
2.2	science	plant.growth	41	2	1	1	1
2.3	misc	class.meetingI	15	1	1	1	2
2.4	r&la	story.readingI	9	1	1	1	1
2.5	r&la	facts.p.bioII	47	4	2	2	1
2.7	r&la	library	22	3	1	1	2
2.8	r&la	spellingII	13	2	1	1	1
2.9	social.stdys	iowa.test	8	2	1	1	1
3.1	r&la	spellingIII	108	5	1	1	1
3.2	social.stdys	iowa.kansas	76	3	1	1	1
3.3	r&la	story.readingII	16	1	1	1	1
3.4	mathematics	lines.anglesIII	43	6	1	1	1
3.5	r&la	biographyIII	26	5	1	1	1
4.1	r&la	story.readingIII	13	1	1	1	1
4.2	music	music	68	3	2	2	3
4.3	r&la	biographyIV	12	3	1	1	1
4.4	science	water	31	2	1	1	1
5.1	r&la	spelling.test	27	3	1	1	1
5.2	science	acid.rain	33	6	1	1	1
5.3	r&la	facts.p.bioV	110	2	1	1	1
5.4	misc	class.meetingII	15	1	1	1	2
5.5	misc	excell	35	5	1	1	1
5.6	mathematics	lines.anglesIV	69	5	1	1	2

Then the teacher reviewed the material that had been introduced by having students label the geometrical elements on each of a set of flash cards (12 minutes). Following this drill and practice session, students were directed to copy the definitions from the chalkboard to their notebooks (15 minutes).

Next, the teacher introduced a worksheet to provide additional practice on the identification of lines, points, angles, etc. The worksheet was completed as a whole group activity. A student read each item and provided an answer. If the answer was correct, all students entered the answer on their worksheet; if the answer was wrong, the question was redirected to another student (27 minutes). Following this worksheet, students went over, in group recitation format, short answer, text-based questions on measures of length, area, and volume (pages 332 - 333 in Merrill mathematics) (27 minutes) and a district-produced worksheet (B-36ii) covering similar material on measurement (22 minutes).

Facts paragraph - biography II. On Monday, students had been assigned a homework task. The task was to read a few paragraphs of biographical material on Florence Nightingale of Christopher Columbus from the textbook (page 117, McMillan English series) and write a "facts paragraph" on the material. On Tuesday, Task 2.5 began with the teacher calling on a student to read his or her paragraph aloud. The class then discussed whether or not the paragraph had topic, detail, and concluding sentences. The teacher stated a grade for the paragraph, recorded the grade, then called on the next student (32 minutes). Following review and grading of the facts paragraphs, the class went on to review and grade a worksheet that had also been assigned as homework for Monday night. In this case, students exchanged worksheets and the worksheet items were reviewed in classic recitation format, and graded (11 minutes). The class then listened to the teacher comment briefly on identification and interpretation of a biography and read a paragraph from the textbook describing biographies (4 minutes).

An examination of Table 4 indicates that the observed tasks were relatively homogeneous in terms of task size, cognitive complexity, and complexity of the social organization necessary to complete the product. Tasks were typically small, oriented to factual material, and carried out in the context of teacher directed whole class instruction.

Activities. Table 5 presents the 96 activities (in the order in which they were observed) that constitute the tasks in Table 4. Note that work on all activities (with the exception of music and library) took place at the students' seats. In addition, there were no cases during the observation when more than one task was being worked on in the classroom. With the exception of one activity in mathematics (activity 5.6.5), students were organized as one social work group.

In Table 6, the activities are sorted by activity function (A.Fctn), activity product specification (Pdt.S), and activity duration (A.Dur). Twelve of the activities (13%) were prework activities. There were 52 work activities (54%) and 10 postwork activities (10%). Of the remaining

Table 5: List of activities in the non-ACOT classroom
(in temporal sequence)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	Wk.Gps	Res.1	Res.2	Teach
1.1	spellingI	1	1	1	20	prv	q&q(p)	-	s	1	1	t	-	tb
1.1	spellingI	2	1	1	4	prv	q&a(p)	-	s	1	1	ws	-	tb
1.2	lines.anglesI	1	0	0	5	pr	vd(t)	vd(tm)	s	1	1	-	-	tb
1.2	lines.anglesI	2	1	1	55	prv	ex	q&a	s	1	1	p&p	cb	tb
1.2	lines.anglesI	3	1	1	12	w	q&a(r)	-	s	1	1	fc	-	tb
1.2	lines.anglesI	4	1	1	15	w	sw(c)	-	s	1	1	p&p	cb	tb
1.2	lines.anglesI	5	1	1	27	w	ws(g)	q&a	s	1	1	ws	-	tb
1.2	lines.anglesI	6	1	1	27	pow	rec	-	s	1	1	t	-	tb
1.2	lines.anglesI	7	1	1	22	pow	rec	g	s	1	1	ws	-	tb
1.3	class.election	1	2	2	17	ws	e	-	s	1	1	cb	-	tb
1.4	r.la.reward	1	0	0	4	po	rs	-	s	1	1	prizes	-	tb
1.5	facts.p.bioI	1	1	1	8	prv	q&a(p)	-	s	1	1	ws	-	tb
1.5	facts.p.bioI	2	1	1	13	w	ws(g)	-	s	1	1	ws	-	tb
1.5	facts.p.bioI	3	1	1	3	w	trs	-	s	1	1	ws	-	tb
1.5	facts.p.bioI	4	2	2	3	w	dis	-	s	1	1	ws	-	tb
1.5	facts.p.bioI	5	1	1	17	w	ws(g)	-	s	1	1	ws	t	tb
1.5	facts.p.bioI	6	1	1	12	prv	trs	vd(t)	s	1	1	ws	t	tb
1.6	geographyI	1	1	1	10	pow	rec	-	s	1	1	t	-	tb
1.6	geographyI	2	1	1	16	w	q&a	-	s	1	1	t	-	tb
1.7	rev.hmw.assnmts	1	1	1	2	pr	vd(tm)	q&a	s	1	1	cb	-	tb
1.8	copy.seatwork	1	1	1	11	w	sw(c)	sw(ws)	s	1	1	t	ws	tb
2.1	lines.anglesII	1	1	1	4	w	sw	-	s	1	1	p&p	-	tb
2.1	lines.anglesII	2	1	1	15	pow	t(fc)	-	s	1	1	fc	p&p	tb
2.1	lines.anglesII	3	1	1	22	pow	rec	corr	s	1	1	fc	p&p	tb
2.1	lines.anglesII	4	0	0	4	po	g	-	s	1	1	p&p	-	tb
2.1	lines.anglesII	5	1	1	10	w	q&a(r)	dem	s	1	1	cb	-	tb
2.1	lines.anglesII	6	1	1	10	w	q&a	dem	s	1	1	cb	-	tb
2.1	lines.anglesII	7	1	1	19	w	q&a	dem	s	1	1	cb	-	tb
2.1	lines.anglesII	8	1	1	8	w	q&a	dem	s	1	1	cb	-	tb
2.1	lines.anglesII	9	1	1	30	w	ws(g)	-	s	1	1	ws	-	tb
2.2	plant.growth	1	1	1	6	pow	rec	-	s	1	1	t	-	tb
2.2	plant.growth	2	1	1	35	w	or	q&a	s	1	1	t	-	tb
2.3	class.meetingI	1	3	3	15	ws	cm(s)	-	s	1	1	-	-	tb
2.4	story.readingI	1	1	1	9	w	trs	sw(ws)	s	1	1	books	p&p	tb
2.5	facts.p.bioII	1	1	1	32	pow	or	vf	s	1	1	p&p	-	tb
2.5	facts.p.bioII	2	1	1	7	pow	rec	corr	s	1	1	ws	-	tb
2.5	facts.p.bioII	3	0	0	4	po	g	-	s	1	1	ws	-	tb
2.5	facts.p.bioII	4	1	1	4	prv	ex	q&a	s	1	1	t	-	tb
2.7	library	1	0	0	1	pr	hm	-	s	1	1	books	-	lib
2.7	library	2	1	1	5	w	trs	-	l	1	1	books	-	lib
2.7	library	3	2	2	16	w	clb	sr	l	1	1	books	-	lib
2.8	spellingII	1	1	1	9	prv	rec	q&a	s	1	1	t	p&p	tb
2.8	spellingII	2	1	1	4	w	sw(ws)	-	s	1	1	t	p&p	tb
2.9	iowa.test	1	1	1	6	w	t(ss)	-	s	1	1	p&p	-	tb
2.9	iowa.test	2	0	0	2	pr	vd(t)	-	s	1	1	t	-	tb
3.1	spellingIII	1	0	0	20	po	vf-	vd(tm)	s	1	1	-	-	tb
3.1	spellingIII	2	1	1	9	pow	rec	-	s	1	1	t	p&p	tb
3.1	spellingIII	3	1	1	2	prv	vd(t)	q&a(p)	s	1	1	t	-	tb

Table 5 (cont'd): List of activities in the non-ACOT classroom
(in temporal sequence)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	Wk.Gps	Res.1	Res.2	Teach
3.1	spellingIII	4	1	1	33	w	q&a	-	s	1	1	cb	-	tb
3.1	spellingIII	5	1	1	44	w	ws(g)	q&a	s	1	1	ws	-	tb
3.2	iowa.kansas	1	0	0	6	po	vd(tm)	vf	s	1	1	t	p&p	tb
3.2	iowa.kansas	2	1	1	41	pow	rec	q&a	s	1	1	t	p&p	tb
3.2	iowa.kansas	3	1	1	29	w	q&a	ex	s	1	1	t	-	tb
3.3	story.readingII	1	1	1	16	w	trs	sw(ws)	s	1	1	books	ws	tb
3.4	lines.anglesIII	1	0	0	11	pr	vd(t)	vd(tm)	s	1	1	ws	-	tb
3.4	lines.anglesIII	2	1	1	8	w	sw(ws)	-	s	1	1	ws	-	tb
3.4	lines.anglesIII	3	1	1	14	pow	rec	corr	s	1	1	ws	-	tb
3.4	lines.anglesIII	4	0	0	4	po	g	-	s	1	1	ws	-	tb
3.4	lines.anglesIII	5	1	1	3	w	q&a	-	s	1	1	cb	-	tb
3.4	lines.anglesIII	6	0	0	3	pr	vd(t)	-	s	1	1	ws	-	tb
3.5	biographyIII	1	0	0	2	pr	vd(t)	-	s	1	1	t	-	tb
3.5	biographyIII	2	1	1	2	w	sr	-	s	1	1	t	-	tb
3.5	biographyIII	3	1	1	6	w	trs	-	s	1	1	t	-	tb
3.5	biographyIII	4	2	2	14	w	dis	-	s	1	1	-	-	tb
3.5	biographyIII	5	1	1	2	w	ex	-	s	1	1	t	-	tb
4.1	story.readngIII	1	1	1	13	w	trs	sw(ws)	s	1	1	books	ws	tb
4.2	music	1	2	1	30	w	music	-	mr(m)	1	1	pipes	sm	other
4.2	music	2	1	1	36	w	music	-	mr(m)	1	1	pipes	sm	other
4.2	music	3	0	0	2	po	g	-	s	1	1	-	-	other
4.3	biographyIV	1	0	0	2	pr	hm	-	s	1	1	t	p&p	tb
4.3	biographyIV	2	1	1	8	pow	rec	corr	s	1	1	t	-	tb
4.3	biographyIV	3	0	0	2	pr	vd(t)	-	s	1	1	t	-	tb
4.4	water	1	2	2	6	w	dis	-	s	1	1	t	-	tb
4.4	water	2	1	1	25	w	or	q&a	s	1	1	t	-	tb
5.1	spelling.test	1	0	0	4	pr	vd(tm)	-	s	1	1	-	-	tb
5.1	spelling.test	2	1	1	13	w	st	-	s	1	1	p&p	-	tb
5.1	spelling.test	3	1	1	10	pow	rec	corr	s	1	1	p&p	-	tb
5.2	acid.rain	1	1	1	3	w	q&a	t	s	1	1	t	-	tb
5.2	acid.rain	2	1	1	3	w	trt	-	s	1	1	t	-	tb
5.2	acid.rain	3	2	2	13	w	ex	q&a	s	1	1	spr	-	tb
5.2	acid.rain	4	2	2	6	w	dis	-	s	1	1	-	-	tb
5.2	acid.rain	5	1	1	2	w	q&a	-	s	1	1	t	-	tb
5.2	acid.rain	6	1	1	6	w	ex	q&a	s	1	1	t	-	tb
5.3	facts.p.bioV	1	1	1	22	prw	vd(t)	q&a(p)	s	1	1	t	-	tb
5.3	facts.p.bioV	2	1	1	88	w	sw(ws)	-	s	1	1	t	p&p	tb
5.4	class.meetingII	1	3	3	15	ws	cm(s)	-	s	1	1	-	-	tb
5.5	excell	1	0	0	6	po	excel(v)	-	s	1	1	-	-	tb
5.5	excell	2	0	0	7	pr	vd(t)	q&a(p)	s	1	1	ws	-	tb
5.5	excell	3	2	2	6	w	sw(ws)	-	s	1	1	ws	-	tb
5.5	excell	4	1	1	12	w	esi	-	s	1	1	ws	-	tb
5.5	excell	5	0	0	4	po	excel(v)	-	s	1	1	-	-	tb
5.6	lines.anglesIV	1	0	0	7	po	vf	-	s	1	1	-	-	tb
5.6	lines.anglesIV	2	1	1	20	w	q&a(r)	dem	s	1	1	cb	-	tb
5.6	lines.anglesIV	3	1	1	23	w	ws(g)	-	s	1	1	ws	-	tb
5.6	lines.anglesIV	4	0	0	6	pr	vd(t)	-	s	1	1	ws	-	tb
5.6	lines.anglesIV	5	1	1	13	w	sw(tc)	-	s	1	1	ws	-	tb

Table 6: List of activities in the non-ACOT classroom
(sorted by A.Fctn, Pdt.S, and A.Dur)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	Wk.Gps	Res.1	Res.2	Teach
3.4	lines.anglesIII	1	0	0	11	pr	vd(t)	vd(tm)	s	1	1	ws	-	tb
5.5	excell	2	0	0	7	pr	vd(t)	q&a(p)	s	1	1	ws	-	tb
5.6	lines.anglesIV	4	0	0	6	pr	vd(t)	-	s	1	1	ws	-	tb
1.2	lines.anglesI	1	0	0	5	pr	vd(t)	vd(tm)	s	1	1	-	-	tb
5.1	spelling.test	1	0	0	4	pr	vd(tm)	-	s	1	1	-	-	tb
3.4	lines.anglesIII	6	0	0	3	pr	vd(t)	-	s	1	1	ws	-	tb
3.5	biographyIII	1	0	0	2	pr	vd(t)	-	s	1	1	t	-	tb
2.9	iowa.test	2	0	0	2	pr	vd(t)	-	s	1	1	t	-	tb
4.3	biographyIV	1	0	0	2	pr	hm	-	s	1	1	t	p&p	tb
4.3	biographyIV	3	0	0	2	pr	vd(t)	-	s	1	1	t	-	tb
1.7	rev.hmw.assnmts	1	0	0	2	pr	vd(tm)	q&a	s	1	1	cb	-	tb
2.7	library	1	0	0	1	pr	hm	-	s	1	1	books	-	lib
1.2	lines.anglesI	2	1	1	55	prw	ex	q&a	s	1	1	p&p	cb	tb
5.3	facts.p.bioV	1	1	1	22	prw	vd(t)	q&a(p)	s	1	1	t	-	tb
1.1	spellingI	1	1	1	20	prw	q&q(p)	-	s	1	1	t	-	tb
1.5	facts.p.bioI	6	1	1	12	prw	trs	vd(t)	s	1	1	ws	t	tb
2.8	spellingII	1	1	1	9	prw	rec	q&a	s	1	1	t	p&p	tb
1.5	facts.p.bioI	1	1	1	8	prw	q&a(p)	-	s	1	1	ws	-	tb
1.1	spellingI	2	1	1	4	prw	q&a(p)	-	s	1	1	ws	-	tb
2.5	facts.p.bioII	4	1	1	4	prw	ex	q&a	s	1	1	t	-	tb
3.1	spellingIII	3	1	1	2	prw	vd(t)	q&a(p)	s	1	1	t	-	tb
2.7	library	3	2	2	16	w	clb	sr	l	1	1	books	-	lib
3.5	biographyIII	4	2	2	14	w	dis	-	s	1	1	-	-	tb
5.2	acid.rain	3	2	2	13	w	ex	q&a	s	1	1	spr	-	tb
5.2	acid.rain	4	2	2	6	w	dis	-	s	1	1	-	-	tb
5.5	excell	3	2	2	6	w	sw(ws)	-	s	1	1	ws	-	tb
4.4	water	1	2	2	6	w	dis	-	s	1	1	t	-	tb
1.5	facts.p.bioI	4	2	2	3	w	dis	-	s	1	1	ws	-	tb
5.3	facts.p.bioV	2	1	1	88	w	sw(ws)	-	s	1	1	t	p&p	tb
3.1	spellingIII	5	1	1	44	w	ws(g)	q&a	s	1	1	ws	-	tb
4.2	music	2	1	1	36	w	music	-	mr(m)	1	1	pipes	sm	other
2.2	plant.growth	2	1	1	35	w	or	q&a	s	1	1	t	-	tb
3.1	spellingIII	4	1	1	33	w	q&a	-	s	1	1	cb	-	tb
4.2	music	1	2	1	30	w	music	-	mr(m)	1	1	pipes	sm	other
2.1	lines.anglesII	9	1	1	30	w	ws(g)	-	s	1	1	ws	-	tb
3.2	iowa.kansas	3	1	1	29	w	q&a	ex	s	1	1	t	-	tb
1.2	lines.anglesI	5	1	1	27	w	ws(g)	q&a	s	1	1	ws	-	tb
4.4	water	2	1	1	25	w	or	q&a	s	1	1	t	-	tb
5.6	lines.anglesIV	3	1	1	23	w	ws(g)	-	s	1	1	ws	-	tb
5.6	lines.anglesIV	2	1	1	20	w	q&a(r)	dem	s	1	1	cb	-	tb
2.1	lines.anglesII	7	1	1	19	w	q&a	dem	s	1	1	cb	-	tb
1.5	facts.p.bioI	5	1	1	17	w	ws(g)	-	s	1	1	ws	t	tb
3.3	story.readingII	1	1	1	16	w	trs	sw(ws)	s	1	1	books	ws	tb
1.6	geographyI	2	1	1	16	w	q&a	-	s	1	1	t	-	tb
1.2	lines.anglesI	4	1	1	15	w	sw(c)	-	s	1	1	p&p	cb	tb
1.5	facts.p.bioI	2	1	1	13	w	ws(g)	-	s	1	1	ws	-	tb
4.1	story.readngIII	1	1	1	13	w	trs	sw(ws)	s	1	1	books	ws	tb
5.1	spelling.test	2	1	1	13	w	st	-	s	1	1	p&p	-	tb

Table 6 (cont'd): List of activities in the non-ACOT classroom
(sorted by A.Fctn, Pdt.S, and A.Dur)

Task#	Task.name	Act#	Pcs.S	Pdt.S	A.Dur	A.Fctn	Fmt.1	Fmt.2	Loc	T#	Wk.Gps	Res.1	Res.2	Teach
5.6	lines.anglesIV	5	1	1	13	w	sw(tc)	-	s	1	1	ws	-	tb
1.2	lines.anglesI	3	1	1	12	w	q&a(r)	-	s	1	1	fc	-	tb
5.5	excell	4	1	1	12	w	esi	-	s	1	1	ws	-	tb
1.8	copy.seatwork	1	1	1	11	w	sw(c)	sw(ws)	s	1	1	t	ws	tb
2.1	lines.anglesII	5	1	1	10	w	q&a(r)	dem	s	1	1	cb	-	tb
2.1	lines.anglesII	6	1	1	10	w	q&a	dem	s	1	1	cb	-	tb
2.4	story.readingI	1	1	1	9	w	trs	sw(ws)	s	1	1	books	p&p	tb
2.1	lines.anglesII	8	1	1	8	w	q&a	dem	s	1	1	cb	-	tb
3.4	lines.anglesIII	2	1	1	8	w	sw(ws)	-	s	1	1	ws	-	tb
2.9	iowa.test	1	1	1	6	w	t(ss)	-	s	1	1	p&p	-	tb
3.5	biographyIII	3	1	1	6	w	trs	-	s	1	1	t	-	tb
5.2	acid.rain	6	1	1	6	w	ex	q&a	s	1	1	t	-	tb
2.7	library	2	1	1	5	w	trs	-	l	1	1	books	-	lib
2.1	lines.anglesII	1	1	1	4	w	sw	-	s	1	1	p&p	-	tb
2.8	spellingII	2	1	1	4	w	sw(ws)	-	s	1	1	t	p&p	tb
1.5	facts.p.bioI	3	1	1	3	w	trs	-	s	1	1	ws	-	tb
5.2	acid.rain	2	1	1	3	w	trt	-	s	1	1	t	-	tb
5.2	acid.rain	1	1	1	3	w	q&a	t	s	1	1	t	-	tb
3.4	lines.anglesIII	5	1	1	3	w	q&a	-	s	1	1	cb	-	tb
5.2	acid.rain	5	1	1	2	w	q&a	-	s	1	1	t	-	tb
3.5	biographyIII	5	1	1	2	w	ex	-	s	1	1	t	-	tb
3.5	biographyIII	2	1	1	2	w	sr	-	s	1	1	t	-	tb
5.4	class.meetingII	1	3	3	15	ws	cm(s)	-	s	1	1	-	-	tb
2.3	class.meetingI	1	3	3	15	ws	cm(s)	-	s	1	1	-	-	tb
1.3	class.election	1	2	2	17	ws	e	-	s	1	1	cb	-	tb
3.2	iowa.kansas	2	1	1	41	pow	rec	q&a	s	1	1	t	p&p	tb
2.5	facts.p.bioII	1	1	1	32	pow	or	vf	s	1	1	p&p	-	tb
1.2	lines.anglesI	6	1	1	27	pow	rec	-	s	1	1	t	-	tb
1.2	lines.anglesI	7	1	1	22	pow	rec	g	s	1	1	ws	-	tb
2.1	lines.anglesII	3	1	1	22	pow	rec	corr	s	1	1	fc	p&p	tb
2.1	lines.anglesII	2	1	1	15	pow	t(fc)	-	s	1	1	fc	p&p	tb
3.4	lines.anglesIII	3	1	1	14	pow	rec	corr	s	1	1	ws	-	tb
1.6	geographyI	1	1	1	10	pow	rec	-	s	1	1	t	-	tb
5.1	spelling.test	3	1	1	10	pow	rec	corr	s	1	1	p&p	-	tb
3.1	spellingIII	2	1	1	9	pow	rec	-	s	1	1	t	p&p	tb
4.3	biographyIV	2	1	1	8	pow	rec	corr	s	1	1	t	-	tb
2.5	facts.p.bioII	2	1	1	7	pow	rec	corr	s	1	1	ws	-	tb
2.2	plant.growth	1	1	1	6	pow	rec	-	s	1	1	t	-	tb
3.1	spellingIII	1	0	0	20	po	vf-	vd(tm)	s	1	1	-	-	tb
5.6	lines.anglesIV	1	0	0	7	po	vf	-	s	1	1	-	-	tb
5.5	excell	1	0	0	6	po	excel(v)	-	s	1	1	-	-	tb
3.2	iowa.kansas	1	0	0	6	po	vd(tm)	vf	s	1	1	t	p&p	tb
5.5	excell	5	0	0	4	po	excel(v)	-	s	1	1	-	-	tb
2.1	lines.anglesII	4	0	0	4	po	g	-	s	1	1	p&p	-	tb
1.4	r.la.reward	1	0	0	4	po	rs	-	s	1	1	prizes	-	tb
3.4	lines.anglesIII	4	0	0	4	po	g	-	s	1	1	ws	-	tb
2.5	facts.p.bioII	3	0	0	4	po	g	-	s	1	1	ws	-	tb
4.2	music	3	0	0	2	po	g	-	s	1	1	-	-	other

22 activities, 9 (9%) were combinations of prework and work and 13 (14%) were combinations of postwork and work.

Degree of product specification. An examination of Table 6 indicates that the activity products were highly specified at the time they were assigned to students. In a few cases, for example, in class discussions of water and acid rain (activities 4.4.1, 5.2.3, and 5.2.4), there were moderate opportunities for students to influence activity processes and products.

Student Empowerment Revisited

In the rationale for this study, student empowerment was described as an internal student state that lies somewhere between the conative and affective domains. From this viewpoint, empowerment results when students perceive themselves to be the source of, or in control of, their own learning. In what follows, a somewhat more economic argument is presented. The two views, which are by no means antithetical, are introduced in an attempt to broaden the discussion of student empowerment.

The general meaning of the term empowerment is "to give official authority to or to delegate power to" (Webster's Third New International Dictionary, 1966). Student empowerment then, results when students are given (or have delegated to them) official authority. From where or from whom is authority delegated to students? Since this discussion is primarily concerned with classroom phenomena, then student empowerment deals with the allocation of power between classroom teachers and students.

Although the term student empowerment is typically used without any delimiting or qualifying phrase, it will be useful for this discussion to refer to empowerment for some purpose, or in some domain. This discussion concerns student empowerment for learning.

Power is exercised in the domain of learning by causing certain content areas, interaction patterns, school work products, and evaluation systems to be chosen for implementation. Student empowerment for learning varies to the extent that students can cause or control various elements of content, process, product, and evaluation in areas related to their own learning. When students control few elements in the learning environment, student empowerment is low; when students control many elements in the learning environment, student empowerment is high.

The amounts and kinds of student learning that result from environments of relatively low or high student empowerment are not the subject of this study. Although the issue of who learns what in which learning environment is a key question, it is beyond the scope of this report. The purpose of this report is to describe the state or level of student empowerment in the regular Nashville ACOT class and to describe the mechanisms through which educational technologies (computers in this case), influence the level of student empowerment.

Student empowerment cannot be observed directly, but must be inferred from actions taken by students and teachers. Power is exercised when students generate or choose among real alternatives for the processes or products of schoolwork. The number of student-initiated ideas and actions and what becomes of, or happens as a result of, these ideas are key indicators of student empowerment in the classroom. Where students make many initiations and these ideas or suggestions influence the

activities undertaken in the classroom, then student empowerment is relatively high. Many examples of indirect indicators of student empowerment in the ACOT classroom were observed during the week of data collection.

During Lego Logo (Task 1.3) on Monday morning, students made decisions about the product to be produced and about some of the processes used to build and test the models (see earlier description of this task). Review of the videotape of this task revealed, high levels of engagement by students, and when the end of the work period was signalled by the teacher, students verbalized their disappointment at having to stop. Although the students did not make choices about the roles to be taken during Lego Logo, they did decide which student would take which role. Clearly students were delegated power to make decisions in some areas and not in others and these decisions affected the social organization of the task, as well as, the content of the models to be built.

During the Showtime tasks (Tasks 1.4, 2.5, 3.4, 4.4, and 5.4), students were delegated power to make a series of decisions about writing a play. There were limits on the areas in which students could make decisions, but students had considerable discretion in developing their plays.

In Task 1.5, students wrote outlines from text material provided by the teacher. Seven texts were provided from which the students could choose. This decision was more constrained (students choose among fixed alternatives) than several of the decisions undertaken in Lego Logo and Showtime (students actually generated many of the alternatives), but some discretion was allowed. In another example involving Journal I (Task 1.9), students were relatively unconstrained in what they choose to write about or in how much they wrote. In another case, that was not captured in the schoolwork tasks in Table 1, several students came to school early each day to work on a student newspaper. Participation in this activity was at the discretion of students and during the work itself, students exercised considerable power in choosing and framing newspaper items.

On Wednesday, during the science lesson, a student suggested (and several others joined in support) that the class make a data base on plants and various aspects of their care and feeding. Although this suggestion was not adopted, the suggestion itself constitutes an initiation of the part of students and is, therefore, an indicator of student empowerment.

Although many other examples could be cited, these examples indicate the levels of decisions being made and actions being taken by students in the ACOT classroom. As the number and size of these decisions increases, the level of student empowerment increases.

These examples from the ACOT class indicate that student empowerment fluctuates over time. During some portion of school work, the level of student empowerment can be at a relatively high level and during other portions, the level may be lower. Therefore, it should be possible to

plot the level of student empowerment over time and subsequently to describe classes in terms of the average levels of student empowerment and the shape of the distribution over time. For the two classes observed in this study, the ACOT class was described as having a higher average level of student empowerment and considerably more variation in levels of student empowerment over the course of the week during which data were collected. Relatively little is known about the effects of average level of student empowerment (or of various "profiles of student empowerment" over time) on student learning, student attitudes, or on classroom management. Although research on these relationships is critically important, an empirical examination of these issues is well beyond the scope of this study.

Classroom Conditions that Affect Student Empowerment

The key issue for this study is to identify classroom conditions that correlate, or covary with level of student empowerment and to examine the role of educational technology in this covariation. Four interrelated factors have been identified in the data that covary with the level of student empowerment. The identification of these factors is tentative, in that, the study is descriptive; no manipulations of conditions has been attempted. There is somewhat stronger evidence for some factors than for others. Several of the factors may be necessary conditions, but none appears to be sufficient for determining level of student empowerment.

(1) Degree of product specification. A key factor that was associated with level of student empowerment in the Nashville ACOT classroom was the degree to which work products were specified by students. When work products (and work processes) were completely specified by someone (or something) other than the students, then the level of student empowerment was very low. There is simply no possibility or opportunity for exercising student discretion in such tasks. As the level of student specification of products (or processesses
beyond a certain point, then level of student empowerment may actually drop off. The inverted u shape is not unusual in many kinds of complex systems and very likely applies to the other factors (described below) as well.

(2) Task size. As tasks increased in size in the Nashville ACOT classroom, the level of student empowerment increased. That is, higher levels of student empowerment were associated with tasks like writing a play as opposed to worksheet tasks. Although size was confounded with ses beyond a certain point, then level of student empowerment may actually drop off. The inverted u shape is not unusual in many kinds of complex systems and very likely applies to the other factors (described below) as well.

(2) Task size. As tasks increased in size in the Nashville ACOT classroom, the level of student empowerment increased. That is, higher levels of student empowerment were associated with tasks like writing a play as opposed to worksheet tasks. Although size was confounded with a number of other variables, those tasks that required substantial amounts of effort, were relatively long in duration, and had several intermediate

products had higher levels of student empowerment, on the average, than tasks that had short duration, no intermediate products and required relatively little effort to complete.

(3) Level of task complexity. In the Nashville ACOT classroom, higher levels of student empowerment were associated with tasks that were cognitively complex and when social organization for the task was relatively complex. Cognitively complex tasks required students to restructure information, generate open-ended responses, synthesize information, develop and apply strategies, and solve problems while tasks of low cognitive complexity required students to recognize or recall information that had been presented previously, and label and classify objects or concepts. In addition, tasks that required relatively complex social organization such as role differentiation and teamwork were associated with higher student empowerment when compared to tasks that each student completed in parallel or in teacher-led whole group instruction formats.

(4) Evaluative feedback. In the Nashville ACOT classroom, higher levels of student empowerment were associated with tasks where there was relatively little personal feedback presented in public settings (as opposed to private settings) and feedback was task related (as opposed to person related) during student work activities. The analysis of evaluative feedback was not extensive in this study, but the data that were available indicated that higher levels of student empowerment were associated with feedback that encouraged task involvement (as opposed to ego involvement (Nicholls, 1984)).

In the Nashville ACOT classroom, the four factors that were associated with student empowerment were also related to high access to computers. As demonstrated in the analysis of Table 3, computers played increasingly prominent roles in work activities as the degree of student product specification increased. It was also demonstrated in Tables 1, 2, and 3 that the larger, more complex tasks frequently involved computers directly in their implementation. In addition, the use of computers reduces the amount of public feedback and person related feedback that students received during school work. That is, all feedback provided on the computer was private (except for those times when two or more students were working on the same machine) and most often task related rather than person-related. Since the computer is inanimate, as a source of feedback it is less likely to result in ego involvement by students.

Summary and concluding remarks. In the Nashville ACOT classroom, high access to computers was associated with higher student product specification, larger, more complex tasks and task environments that had relatively low frequency of public feedback that was person-related. These were the very conditions that were associated with higher levels of student empowerment. Therefore, high access to computers is associated with higher levels of student empowerment.

When distributions of tasks and their characteristics are examined in the ACOT and non-ACOT classrooms, for smaller, less complex tasks where

students had little or no influence on task specification, the distributions are quite similar. However, the larger, more complex tasks with relatively high student product specification (task characteristics that were supported by and most often implemented with computers) simply did not occur in the non-ACOT classroom (a classroom with low access to computers). Although there were many other differences in these two classrooms in addition to high access to computers, there is an apparent association between access to computers and level of student empowerment.

Why might this be so? One possible and plausible explanation concerns the relation between task size, complexity, and degree of product (and process) specification on the one hand, and classroom management on the other. In general, classroom management problems increase as task size, complexity, and student specification increases. Given the usual range of student abilities, motivations, and prior knowledge that exist in typical classrooms, large complex, partially specified tasks are difficult to manage, time consuming, and difficult to justify when district-specified content coverage is highly valued (and rewarded). These barriers appear to be less potent when high access to computers is introduced. This may be partly due to the ability of computers to "absorb" more student variation in terms of student work rates, levels of prior knowledge, and quality and quantity of student products before the classroom management problem becomes overwhelming. It may also be true that larger tasks can be more easily "scaffolded" with moderately sophisticated software than would be the case if the task were attempted without computers.

This study provides evidence that high access to computers was associated with increased student empowerment in classroom learning settings. If increased student empowerment is a valued goal in itself, then one way to achieve that goal is to introduce computers to support the implementation of larger, more complex, partially specified tasks. Before going very far in the exploitation of this relationship, it is increasingly important to document the effects of various "profiles of student empowerment" (or distribution of schoolwork task characteristics) on student learning. One step in this direction would be accomplished by comparing the quality and quantity of student products produced in classrooms with distinctly different profiles of student empowerment (i.e., distributions of student work task characteristics and associated levels of access to computers).

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Appendix A: Task Description Form

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(-127)

TASK DESCRIPTION

ID# ACOT 222 Grade 4 Task# 5.4 Task.name SHOWTIME V

T.S.date 4-15-88 #Task.days 1 Task.duration 67

Subject.gen P&LA #Acts 3

Subject.spec SHOWTIME (LEARN'S GROUP PRESENTS - BRAINED + MORE CREATION OF PLAY TIME)

T.pdt.cmplxy 5 T.soc.cmplxy 3

Task ize(ind) 4 Task.size(gp/soc) 3

Task.purpose(primary) PFP
(task/product used for)

Who.sees.product (1)

What.purpose (1,2)

Product.evaluation (5)

Relation.other.current.schl/nonschl.tasks 11.

Review tape (___-_____) for _____

Comments definitions 6 and 8 are only examples. Not of a repertoire (Pc) * * * *

	Act.	Product Description	Process Description	Student Act Prcs	Spec Prdt	Format Description	Format Code	Lo
L	1	D's listen to Tosh management directions	Tosh will give directions not in them to that before classtime	NA —	NA —		VD(TM)	S
L	2	~~unpattern generalization of definition play~~ D's listen to expl. of end. sheet	(RH has added grading sheet today - Cohort 4 D's not doing shuttles - math test etc.	NA —	NA —		VD(T)	F
L	3	S's review heads grasp play and score it	pun play on BS —	? 3	? 3	Viewing and scoring play	VSP	F
L	4	Juniors unpacking position leg grasp	—	~~NA~~ ? —	~~NA~~ ? —		G	F
L	5	D's and T give feedback on play techniques	—	? —	? —	Discussion feedback	DIS VF	F
L	6	D's listen for what next	—	NA —	NA —		VD(T)	F
L		Word on Shuttle's practice in team	—	5	5	computer sys	CW(S)	S(T)
L				NA —	NA —	strokes	Q and A	F

S.time	End Time	Duratn	Fctn	Tchr	#Diff Task	#Wk Gps	Resources Description	Res Prim	Res Sec
10:40	10:42	2	Pr	RH	1	1	—	—	—
10:42	10:47	5	Pr	RH	2	2	~~optimum alertness~~ p and p	~~SW~~ p and p.	~~p and p~~
10:47	10:59	12	~~Pr~~ PoN	RH	2	2	optimum leg exam p and p	SW	BS/ p and p
10:59	11:01	2	Po	RH	2	2	p and p	p and p	
11:01	11:03	2	Po	RH	2	2	—	—	—
11:03 *	11:05	2	Pr	RH	2	2	—	—	—
11:05	11:47	42	W	RH	2	9+	observation paper and pencil	SW	p and p
11:47 * 1149		2	Po	RH	1	1	none	—	—

Appendix B: Coding Keys for Tables 2, 3, 5, and 6

Location Codes

S = regular seats
F = front (some students on floor, some in seats near chalkboard)
LLT = Lego Logo tables
S(T) = seats; teams for Showtime
L = library
Hardtop = outside school on asphalt area
Hall = central hallway for music
MR(M) = Moore's room for music

Format Codes

VD(T) = verbal directions by teacher related to task
SW(WS) = seatwork; worksheet-like material
Dem = Teacher demonstrates (non-verbal) performance of "problem"
Ex = teacher explains, lectures about content (teacher talk > 80%)
CW(DP) = computer work (drill and practice)
SW(TP) = test or textbook problems in mathematics
VD(TM) = teacher verbal directions; task management
SGLLC = small group Lego Logo construction
Dis = discussion (student talk greater than or equal to 50%)
Q&A = teacher questions; students answer (not recitation)
Dem(C) = computer delivered demonstration
CW(S) = computer work on Showtime (three students/one computer per team)
SW(WO) = writing outline
Rec = teacher leads question/answer session where students are answering questions from material studied previously
VF = verbal feedback (evaluative)
SW(R) = reading
SW(SW) = seatwork; Showtime worksheet
LB = library browsing
TRS = teacher (or librarian) reads story to students
G = grading; teacher records grades as students call out how many "items" they missed
Special = balloon launch (in class session)
Hardtop = balloon launch outside
SW(WL) = writing letter
ST(R) = spelling test; riddle format
VSP = group viewing and scoring of Showtime play
Music = a combination of playing pipes, singing and dancing
CW(DPT) = drill and practice typing

Q&A(P) = question and answer format primarily previewing work to be done later
Q&A(R) = review (see math lesson Monday 10:15)
SW(C) = seatwork; copying from board

WS(G) = worksheet done as a whole group (> 50% teacher talk; like Q&A with a worksheet)
E = election
RS = reward session
SW(S) = seatwork; studying independently for quiz
T(FC) = test with teacher using flashcards, mathematics
OR = oral reading by individual students, science (Tu @ 11:00; Th @ 2:35)
CM(S) = class meeting (social sharing)
CORR = students correcting their own or another student's paper(work)
HM = handout (or in) materials (library books)
CLB = choose library book
SR = silent reading
T(SS) = test; social studies
ST = spelling test
TRT = teacher reads from textbook
EXCEL(V) = voting during EXCEL; plus teacher reading student EXCEL material
ESI = EXCELL; share ideas
SW(TC) = seatwork; table by table competition (Friday PM math)

(Note: when more than one code was used for the same activity; the codes represent formats in order of the instructional time for which they account)

Resources Codes

T = textbook
WB = workbook
CB = chalkboard
SW = software
LL = Lego Logo
C = computer
P&P = paper and pencil
BS = big screen; device for projecting computer "screens"
HO = handout
Di = dictionary
Books = general literature, library books for example
PC = "president" cards
TBB = Tennessee blue book
TS = test sheet
SM = sheet music; newsprint
Pipes = student music pipes

FC = flashcards; mathematics, lines and angles
Prizes = rewards given to students; pencils, stickers, etc.
SPr = science project (Shelly's on Friday @ 9:21)